United States
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Conservation
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In cooperation with
University of Alaska
Fairbanks Agricultural
and Forestry Experiment Station, State of
Alaska Department of
Natural Resources,
Kenny Lake Soil and
Water Conservation
District, and Ahtna
Native Corporation

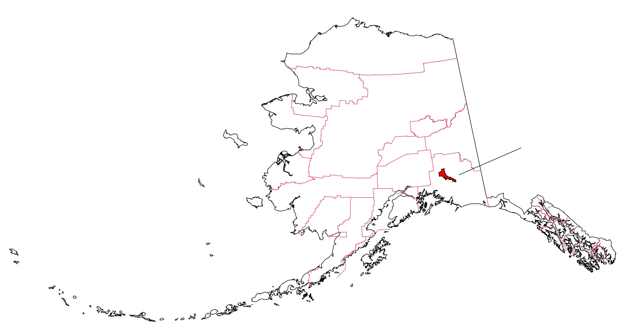
Soil Survey of Copper River Area, Alaska

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture, State agencies including the Agricultural and Forestry Experiment Station, and local agencies. The Natural Resources Conservation Service (formerly Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1984. Soil names and descriptions were approved in 1990. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1984. This survey was made cooperatively by the Natural Resources Conservation Service, the University of Alaska Fairbanks Agricultural and Forestry Experiment Station, State of Alaska Department of Natural Resources, and the Ahtna Native Regional Corporation. It is part of the technical assistance furnished to the Kenny Lake Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

Cover: In the foreground are the Kenny Lake and Copper River soils. The Kenny Lake soils were perennially frozen. Clearing allowed the permafrost to thaw and provide a suitable site for growing adapted varieties of vegetables, short season grains, potatoes, and hay. The Copper River soils are perennially frozen and support a stand of dwarf black spruce and white spruce. The Tonsina soils shown in the background are on drumlins and till plains and have potential use as hayland and pastureland.



Location of the Copper River Area in Alaska

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Foreword

This soil survey contains information that can be used in land-planning programs in the Copper River Area. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow to bedrock or permafrost. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the Alaska Cooperative Extension.

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Soil Survey of
Copper River Area, Alaska

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United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with
University of Alaska Fairbanks Agricultural and Forestry Experiment Station, State of Alaska Department of Natural Resources, Kenny Lake Soil and Water Conservation District, and Ahtna Native Corporation

The Copper River Area is located in southcentral Alaska approximately 150 miles (240 km) east of Anchorage. The area extends from the village at Gakona, southeast along the Copper River to the town of Chitina. It encompasses much of the Copper River basin below 2,000 feet (600 m) elevation and has an area of about 597,403 acres.

Broad, nearly level terraces, which extend for several miles on each side of the Copper River, are the most extensive features in the survey area (Figure 1). These terraces consist of clayey lacustrine sediments deposited by a large proglacial lake that occupied the basin during the last Pleistocene glaciation. The lake formed when advancing lobes of ice dammed the channel of the Copper River through the Chugach Mountains. The Copper River and its tributaries have since incised these lakebed deposits forming escarpments up to 300 feet (91 m) high and a step sequence of stream terraces. Wind blown sediments of varying thickness mantle the stream terraces and lacustrine terraces in proximity to the river.

Away from the river canyons and above the lacustrine terraces, the landscape is dominated by low relief morainal hills and extensive till plains formed in glacially deposited materials (Figure 2). Steep, rounded hills of moderate relief formed in glacially scoured bedrock in the southeast portion of the survey area.

Permafrost underlies the entire basin at varying depths, except on floodplains and under lakes. Where a thick organic mat overlies the mineral soil, permafrost and a perched water table can occur within the soil profile. Disturbance of this insulating mat by fire or land clearing often results in thawing of the permafrost, deepening of the active layer, and a drop in the water table to below the soil profile. With long-term development of the vegetation toward the original forested condition and the redevelopment of the organic mat, soil temperatures drop, the permafrost level rises, and soil drainage becomes restricted again.

The primary purpose of the Copper River Area soil survey is to provide information about the soils and miscellaneous landtypes in the survey area for potential agricultural development. Secondary objectives are to provide forestry and engineering interpretations. The information contained in this report includes descriptions of the soils and miscellaneous areas; maps showing their location; and discussion of their suitability, limitations, and management for these uses.

A Copper-Chitina soil survey was completed in 1963 but was never published. The present survey updates this earlier survey, provides additional information and larger maps that show the soils in greater detail, and incorporates refined concepts for classifying and mapping soils and improved interpretations for use and management.

Much of the acreage in the survey area has potential for agricultural development. In general, soils best suited for agriculture are those soils below 1500 feet (457 m) elevation with 10 inches (25 cm) or more silty loess on the surface and with no permafrost within 60 inches (152 cm) of the mineral surface. Some soils with shallow permafrost can be converted to agricultural soils with proper management. The best soils for forestry are found on high floodplains, stream terraces, and lacustrine terraces below 1500 feet (457 m) elevation. Productive forest soils are also free of shallow permafrost.

This soil survey is a suitable guide for general land use planning and management, but it does not provide enough detail to develop site-specific plans. Technical guides that are maintained by Natural Resources Conservation Service field offices contain additional information on soils for various conservation practices. Landowners or managers interested in the use and management of the soil and vegetation resources can obtain assistance from the local Natural Resources Conservation Service office. In addition to this assistance, special publications on the use of soils are also available.

General Nature of the Survey Area

History and Settlement

Before the late 1800s, the Copper River basin was inhabited for 5000 to 7000 years by the Ahtna Athabascan Indians. Non-native settlement of the region began in 1896 with the establishment of a trading post and lodge at Copper Center. Demand for an all-American route to the Klondike gold fields prompted construction of a military road from Valdez to Eagle beginning in 1899. By 1901, a telegraph, and by 1905 a school, had been established at Copper Center.

Settlement of the basin increased markedly after about 1910 with the discovery and development of copper deposits in the McCarthy area, and construction of the Copper River and Northwest Railroad through Chitina. For the next quarter century, Chitina remained a major center for travelers and miners on route to interior Alaska. Development continued in the late 1930s and early 1940s with construction of the Glenn and Richardson highways *(Logsdon et al. 1975)*.

In the late 1960s, agricultural development began on a limited scale in the Kenny Lake area. A large influx of people occurred in the early 1970s, stimulated by the construction of the trans-Alaska oil pipeline. Many of these people have since left the area following completion of the pipeline in 1977. For many years, big game hunting, fishing, and tourism have attracted numerous settlers and visitors to the basin.

Most land in the Copper River basin is owned by the United States Department of Interior and managed by the Bureau of Land Management and National Park Service. The State of Alaska, the Ahtna Regional Corporation, and a number of native village corporations also have extensive holdings. Private lands are of limited extent, concentrated primarily within established towns and along the Richardson and Edgerton highways and other roads. Changes in land ownership are occurring, and will continue to occur in years to come, as a result of the Alaska Statehood Act, the Alaska Native Claims Settlement Act, and the Alaska National Interest Lands Conservation Act.

Based on 1980 census figures, approximately 2,720 people live in and adjacent to the survey area, in addition to an unknown number of summer residents and transient workers. Glennallen, at the intersection of the Glenn and Richardson highways, is the largest town in the region and the center of economic activity. Other towns include Gulkana, Copper Center, and Chitina; rural concentrations occur at Gakona, Tazlina, Kenny Lake, Tonsina, and Silver Lake.

Hydrology and Water Supply

The Copper River flows through the center of the survey area. The major tributaries of the Copper River within the survey area are the Gakona, Gulkana, Tazlina, Klutina, Tonsina, and Chitina Rivers. Average flow of the Copper below its confluence with the Chitina is 37,010 cubic-feet (1036 cubic-meters) per second. Maximum flow, which occurs in late July or early August, ranges from 150,000 to 250,000 cubic-feet (4200 to 7000 cubic-meters) per second. Minimum flow in late March or early April is only 2,000 to 8,000 cubic-feet (56 to 224 cubic-meters) per second *(USGS 1979)*.

Except for the Gulkana, all major rivers in the area are of glacial origin. These rivers are characterized by steep gradients, braided floodplains, and high volumes of suspended sediments (Figure 3). The sediment load of the Copper River at Chitina in July 1978 was 2,200 parts per million *(USGS 1979)*. The Gulkana River, which originates at Paxson Lake and in the upper reaches of the basin to the north, is a clear water river for much of the year.

Several mineralized springs, locally referred to as mud volcanoes, occur within 15 miles (24 km) of Glennallen. Mud volcanoes are cone shaped mounds of silt and clay from which mud, gas, and mineralized

water have been discharged *(Nichols and Yehle 1961)*. Two of these springs occur within the survey area, the largest of which, the lower Klawasi mud volcano located east of the Copper River and northeast of Copper Center, is about 150 feet (45 m) high.

Subsurface water throughout much of the area is under artesian pressure beneath fine-grained material and/or permafrost. Wells drilled in Glennallen, Gulkana, and Gakona have produced water that is somewhat saline. Although well log data are limited, water quality is likely to be a wide spread problem when developing a source of potable water *(Nichols 1956)*.

Geology

The Alaska Range and Talkeetna, Chugach, and Wrangell Mountains rim the Copper River Basin. Rocks bordering the basin consist of schist, greenstone, graywacke, shale, and sandstone. Andesite bedrock of Pleistocene age is found in the southeastern part of the survey area.

During one or more early Pleistocene glaciations (35,000 to 9,000 years before present), glaciers from the surrounding mountains covered the entire basin floor. However, the last glacial advance left large areas of the basin ice-free. During periods of each major glaciation, ice dammed the channel of the Copper River through the Chugach Mountains forming a large proglacial lake in the central basin. Lacustrine sediments deposited in the lake partially buried older glacial features. Over time, the lake level fluctuated widely, and eventually drained completely approximately 9,000 years ago *(Ferrians, Nichols, and Williams 1983)*.

Following retreat of the glaciers and drainage of the lake, permafrost began to form in lacustrine and glacial deposits. Rivers began to incise canyons in the lacustrine and glacial sediments, and loess began to accumulate in proximity to the major drainages.

Climate

The climate of the Copper River basin is subarctic continental characterized by long cold winters and short warm summers (Tables 1 and 2). Mean January temperature is -10 °F (-23 °C); daily low temperatures of -50 °F (-46 °C) or less occur frequently during the winter and may last for two or more weeks. Mean July temperature is 56 °F (13 °C); daily high temperatures on occasion exceed 85 °F (30 °C). Although the daily minimum temperature in summer averages in the forties, freezing temperatures have been recorded in every month.

Growing degree days, given in Tables 1 and 2, are equivalent to "heating units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds the base temperature of 40 °F (4.4 °C). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall. Dates of last frost in the spring and first frost in the fall, and length of the frost-free season at 2 stations in the area, are given in Tables 3 and 4. The data shows that the length of the growing season varies greatly from year to year.

Mean annual precipitation across the basin ranges from 8 to 17 inches (23 to 41 cm). Of this, about 38 percent is received as rain during the growing season, which lasts from early June through the end of August. Thunderstorm activity is common during the early summer. During many years, a lack of precipitation in May and June results in a soil moisture deficit during the period of plant emergence.

Average annual snowfall is 47 inches (119 cm) at Old Edgerton Farms in the Kenny Lake area and 49 inches (124 cm) at Glennallen. Although snowfall varies greatly from year to year, at least 1 inch (2.5 cm) of snow is on the ground an average of 180 days per year.

Continuous sunlight and twilight occur from early June through mid-July. Day length at the winter solstice is less than 5 hours long.

Prevailing wind at Gulkana airfield is from the southeast at 6.8 miles per hour (10.9 km per hour).

Permafrost

Permafrost, or perennially frozen ground, underlies most of the Copper River basin. The depth at which it occurs and its ice content varies widely. Permafrost characteristically occurs as ice crystals disseminated throughout the soil. Although not extensive near the soil surface, massive ice wedges and lenses do occur in the subsoil in some areas. A perched water table and saturated conditions are common above the permafrost during the summer due to restricted drainage.

The fire history of the site and the thickness of the insulating organic layer on the soil surface control depth to permafrost and water table, in part. Disturbance of the organic layer usually results in increased soil temperatures and a lowering of the permafrost level. As permafrost thaws, a large volume of water is released. Variation in the ice content of the permafrost and the rate of thawing results in differential subsidence of the soil surface and slumping on steeper slopes (Figure 4). The occurrence of permafrost requires special consideration when

selecting lands for clearing and agriculture and during construction of roads and buildings.

Native Vegetation

The vegetation of the survey area is boreal forest, similar to elsewhere in Interior Alaska. Boreal forest consists of a mosaic of vegetation types reflecting the combined effects of landform, topographic position, soil type, and the occurrence of past fires. The Copper River basin has a long history of frequent wild fires. Between 1900 and 1950, an average of 10,000 acres burned annually, although this average has been reduced with improved fire protection measures *(Barney 1969)*. High-intensity crown fires that typically kill entire stands characterize the natural fire regime *(Viereck and Schandlemeier 1980)*. Stands are then replaced through natural regeneration.

Forest types on productive well drained sites include white spruce, mixed white spruce-aspen, mixed white spruce-balsam poplar, aspen, and, in the southern end of the survey area, mixed white spruce-paper birch. Stunted black spruce and white spruce forests of low productivity occur on north facing slopes and cold, wet sites with shallow permafrost. Following forest fires, willow shrub dominates most sites until eventually replaced by forest vegetation.

Where topographic and soil conditions inhibit tree growth, shrub and herbaceous vegetation develop. Seasonally flooded riverwash on the floodplains of major rivers supports dense alder shrub. Willow and ericaceous shrub occupy bogs, fens, and narrow drainages. Wet sedge meadows are common on the margins of lakes and ponds. Steppe vegetation, characteristic of semi-arid areas elsewhere in northeastern Asia and northwestern North America *(Murry et al. 1983),* is found on steep south-facing terrace escarpments.

Wildlife

The diversity of soils and landforms; variety of vegetation types; and system of lakes, streams, and wetlands of the Copper River Area provide habitat for a wide variety of Alaska’s game and non-game mammals and birds. Population levels are determined by the stage of vegetative succession, interspersion of vegetation types and other habitat features, seasonal animal migrations, hunting and trapping pressure, and other factors. Human uses of area wildlife include subsistence harvesting and trapping, sport hunting, and recreation.

Moose, the most important big game animal in the survey area, are found throughout the Copper River basin. They are common at higher elevations outside the survey area in summer and fall and concentrate along the rivers at lower elevations in winter. The Chitina bison herd inhabits the area between the Cheshnina and Nadina rivers on the east side of the Copper River. Many of the terraces and escarpments in this area are heavily grazed in summer and fall. The winter range and calving grounds of the Nelchina caribou herd are at higher elevations north and east of the survey area. Occasional caribou wander into the lower elevation forests. Dall sheep and mountain goats are found in the Wrangell and Chugach Mountains adjacent to the survey area.

Both black bears and grizzly bears are in the area. Black bears intensively utilize the floodplains and stream terraces along the Copper, Klutina, and other major rivers.

Grizzly bears occur throughout the uplands, and concentrate along the Tonsina and other rivers and streams when spawning salmon are present. Among the more important furbearers in the area are coyote, red fox, martin, mink, lynx, muskrat, and beaver. Snowshoe hare and porcupine are common and locally cause considerable damage to trees.

Approximately 135 species of birds are summer residents of Interior Alaska; another 3 dozen or so are spring-fall migrants or occasional visitors to the region *(Armstrong 1980)*. Many of these birds can be found in suitable habitats in the Copper River basin. A variety of waterfowl, including Trumpeter Swans, nest in the survey area and utilize local lakes and ponds for rearing young. Bald Eagles nest and fish along the major rivers. Spruce Grouse are common in spruce forests throughout the area.

How This Survey Was Made

Before beginning the field survey, relevant literature and other information on the climate, geology, geomorphology, hydrology, and vegetation of the area were assembled and cataloged. At the same time, aerial photography covering the entire survey area was acquired and prepared for field use and mapping. Recent 1978-82 color infrared photography at a nominal scale of 1:60,000 was enlarged to a scale of approximately 1:24,000 and printed in black-and-white for use during the survey. The literature and photography were then studied in detail to determine general soil-landform and soil-vegetation relationships. Discussions with potential users of the survey helped refine specific survey objectives and procedures.

Prior to detailed soils mapping, a reconnaissance of the area was done by low altitude flights over the area. At representative locations and landforms, the soil scientists stopped to investigate the nature of the soils. Specific soil-landform patterns and map unit concepts were developed during the reconnaissance for use during detailed mapping. Representative areas for future intensive soils investigation were identified and located at this time.

The level of mapping intensity was determined, to a large degree, based on accessibility. Areas along the Richardson and Edgerton Highways and other local roads, and areas identified as having high potential for the specified uses of the survey, were mapped at a higher level of intensity. Soil boundaries in these areas were determined in the field. Approximately 70 percent of the survey area was beyond 3 miles (4.8 km) of an existing road and accessible by helicopter, providing suitable landing zones existed (Figure 5). Soil boundaries in these areas were determined in the field at accessible locations; boundaries elsewhere were interpreted from the aerial photography and known soil-landform and soil-vegetation relations.

To map and characterize the soils, soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of native plants; and the kinds of geologic materials. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. Extensive areas of the survey area are underlain by shallow permafrost within the soil profile. In these areas, a gasoline powered ice auger was used to extract frozen soil cores from which the characteristics of the frozen layers could be determined (Figures 6 and 7).

Detailed soils mapping was accomplished by traversing the landscape and observing representative soil profiles, and by transecting representative delineations of each map unit and observing the soil profile at predetermined intervals. A traverse is a field procedure that enables the soil scientist to determine the kinds of soils in an area and to assign a particular soil body to a specific map unit. Geographic variation of the map unit is also determined by traverses. In accessible areas, areas with high development potential, and areas with complex soil patterns, traverses were run at one-third to one-quarter mile intervals. In inaccessible areas, areas with low potential for the specified uses of the survey, and areas with extensive homogeneous soil bodies, traverses were run at two-thirds to a mile intervals.

A transect is a field procedure that enables the soil scientist to determine the range in characteristics of a soil and the composition and location of the soil components of a particular map unit. Detailed information about the soil and landscape is collected at closely spaced intervals. The complexity of a map unit determines the number of transects needed; at least 3 transects were observed for each map unit with high potential for the specified uses of the survey.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation. Each kind of soil and miscellaneous area is associated with a particular kind or segment of the landscape. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept or model of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Individual soils on the landscape commonly merge progressively onto one another as their characteristics gradually change. To construct an accurate map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationships, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted color, texture, size, and shape of soil aggregates; kind and amount of rock fragments; distribution of plant roots; depth to permafrost; reaction; and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil Taxonomy *(USDA 1975)*, the system of taxonomic classification used in the United States and adapted by many other countries around the world, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas, so that they could confirm data and assemble additional data based on experience and research. Thus, Soil Taxonomy provides a basis for the transfer of soils information.

While the soil survey was in progress, samples of some of the soils in the area were collected for laboratory analyses and engineering tests. Soil

scientists interpreted the data from these analyses and tests, as well as the field observed characteristics and the soil properties, to determine the expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses and under different levels of management. Some interpretations were modified to fit local conditions, and some new interpretations were developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Each map unit consists of an area of specified soil or soils having similar use and management. It also contains minor inclusions of soils with different use and management. Each map unit is also defined in terms of nonsoil features such as slope, climate, and landform. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

General Soil Map Units

The general soil map included with this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, it consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The soils or miscellaneous areas making up one unit can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils or miscellaneous areas can be identified on the map. Likewise, areas that are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road, building, or other structure. The soils in any one map unit differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The general map units in this survey have been grouped for broad interpretive purposes. Each of the broad groups and the map units in each group are described on the following pages.

Map Unit Descriptions

Nizina-Klutina-Gulkana Association

Very deep, well and excessively drained soils formed in alluvium and silty loess overlying calcareous alluvium

This map unit occurs on floodplains and stream terraces. Slopes range from 0 to 20 percent and are highly dissected in floodplain areas. The vegetation is dominantly white spruce, quaking aspen, willow, balsam poplar, and alder. Elevation ranges from 600 to 1500 feet (183 to 457 m). Average annual precipitation is about 12 inches (30 cm).

This map unit makes up about 10 percent of the survey area. Nizina soils make up about 35 percent of the unit, Klutina soils about 30 percent, and Gulkana soils about 20 percent. The remaining 15 percent consists of other soils of minor extent.

The nearly level to gently sloping, rarely to occasionally flooded Nizina soils are very deep and excessively drained. The surface is covered with a thin mat of partially decomposed organic material. The mineral surface is typically loamy fine sand 2 to 8 inches (5 to 13 cm) thick. The substratum is extremely cobbly and extremely gravelly sand.

The nearly level to gently sloping, rarely to occasionally flooded Klutina soils are very deep and well drained. The surface is covered with a mat of partially decomposed organic material. The mineral surface is typically very fine sandy loam about 3 inches (8 cm) thick. The upper part of the substratum is stratified very fine sandy loam, fine sand, and sand 12 to 29 inches (30 to 74 cm) thick. The lower part of the substratum is very gravelly sand.

The nearly level to moderately steep, nonflooded Gulkana soils are very deep and well drained. The surface is covered with a thin mat of partially decomposed organic material. The mineral surface and subsoil typically is silt loam 12 to 30 inches (30 to 76 cm) thick. The substratum is very gravelly sand.

Minor components in this unit include riverwash, active river channels, escarpments, and the very poorly drained Kuslina soils on low stream terraces.

The soils in this unit are mainly used for cropland, hayland and pastureland, forestland, wildlife habitat, gravel source areas, and rural homesites.

The main limitation for all uses on Klutina and Nizina soils is flooding.

The main limitations for forestland are cold soil temperatures and escarpments.

The main limitations for cropland, hayland and pastureland, and urban development are excessive permeability on Klutina, Nizina, and Gulkana soils, and shallow depth to gravel on Nizina soils.

Kenny Lake-Tonsina-Copper River Association

Very deep and very shallow, well drained and very poorly drained soils formed in a silty loess mantle overlying lacustrine clays, glacial till, and permafrost

This map unit occurs on lacustrine terraces and glacial till plains. Slopes are dominantly 0 to 7 percent but range from 0 to 20 percent. The vegetation is dominantly white spruce, quaking aspen, and willow on Kenny Lake and Tonsina soils, and black spruce and willow on Copper River soils. Elevation ranges from 900 to 2000 feet (274 to 610 m).

This map unit makes up about 10 percent of the survey area. Kenny Lake soils make up about 30 percent of the map unit, Tonsina soils about 30 percent, and Copper River soils about 30 percent. The remaining 10 percent are soils of minor extent.

The nearly level to moderately steep Kenny Lake soils are very deep and well drained. The surface is covered with a thin mat of partially decomposed organic material. The mineral surface layer and subsoil are typically silt loam 14 to 27 inches (36 to 69 cm) thick. The substratum is silty clay.

The nearly level to moderately steep Tonsina soils are very deep and well drained. The surface is covered with a thin mat of partially decomposed organic material. The mineral surface layer and subsoil are typically silt loam ranging from 14 to 33 inches (36 to 91 cm) in thickness. The substratum is gravelly loam.

The nearly level to moderately steep Copper River soils are very shallow over permafrost and are very poorly drained. The surface is covered with a thick mat of fibrous and partially decomposed organic material. The mineral surface layer typically is silt loam. Permafrost occurs at a depth of 0 to 6 inches (0 to 15 cm).

Minor components in this unit are the very poorly drained Wrangell soils, escarpments, and the somewhat excessively drained Pippin soils.

The soils in this unit are mainly used for hayland and pastureland, forestland, urban development, cropland, and wildlife habitat.

The main limitations for all uses on Copper River soils are permafrost and perched water table.

The main limitations for forestry on the Kenny Lake and Tonsina soils are windthrow and cold soil temperatures.

The main limitations for urban development on the Kenny Lake and Tonsina soils include frost heaving, load support capacity, and restricted permeability.

The main limitations for cropland and hayland and pastureland on the Kenny Lake and Tonsina soils are frost heave, wind and water erosion, limited late spring precipitation, and frequent mid-summer frosts.

Klawasi-Gakona Association

Shallow to moderately deep over permafrost, and very deep, very poorly or poorly drained, and well drained soils formed in a thin mantle of loess over lacustrine clay deposits

This map unit occurs on lacustrine terraces. Slopes are dominantly 0 to 7 percent but range from 0 to 20 percent. The vegetation is dominantly black spruce and willow on Klawasi soils and white spruce, quaking aspen, and willow on Gakona soils. Elevation ranges from 1100 to 2000 feet (335 to 610 m). Average annual precipitation is about 12 inches (30 cm).

This map unit makes up about 30 percent of the survey area. Klawasi soils make up about 50 percent of the unit and Gakona soils about 40 percent. The remaining 10 percent are soils of minor extent.

The nearly level to moderately steep Klawasi soils are shallow to moderately deep over permafrost and are very poorly or poorly drained. The surface is covered with a thick mat of fibrous and partially decomposed organic material. The mineral surface layer and subsoil typically are silt loam 1 to 7 inches (3 to 18 cm) thick. The substratum is calcareous silty clay. Depth to permafrost ranges from 14 to 30 inches (36 to 76 cm) below the surface of the organic mat.

The nearly level to moderately steep Gakona soils are very deep and well drained. The surface is covered with a thin mat of fibrous organic material. The mineral surface layer and subsoil typically are silt loam 1 to 8 inches (3 to 20 cm) thick. The substratum is calcareous silty clay.

Minor components in this unit are the very poorly drained Wrangell soils, the very poorly or poorly drained Mendeltna and Tolsona soils, and the somewhat excessively drained Pippin soils.

The soils in this unit are mainly used for forestland, urban development, cropland, hayland and pastureland, and wildlife habitat.

The main limitations for all uses on Klawasi soils are permafrost and perched water table.

The main limitations for forestland on Gakona soils are low soil temperatures and low bearing capacity.

The main limitations for urban development on Gakona soils are frost heaving, load supporting capacity, and restricted permeability.

The main limitations for cropland and hayland and pastureland on Gakona soils are low available water capacity, wind erosion, and water erosion.

Mendeltna-Chetaslina Association

Shallow to moderately deep over permafrost, and very deep, very poorly to poorly drained, and well drained soils formed in a thin mantle of loess over calcareous loamy lacustrine material

This map unit occurs on lacustrine terraces. Slopes are dominantly 0 to 7 percent. The vegetation is dominantly black spruce and willow on Mendeltna soils and white spruce, quaking aspen, and willow on Chetaslina soils. Elevation ranges from 1400 to 2200 feet (427 to 671 m). Average annual precipitation is about 12 inches (30 cm).

This map unit makes up about 10 percent of the survey area. Mendeltna soils make up about 60 percent of the unit and Chetaslina soils about 30 percent. The remaining 10 percent are soils of minor extent.

The nearly level to gently sloping Mendeltna soils are shallow to moderately deep over permafrost and very poorly or poorly drained. The surface is covered with a thick mat of fibrous and partially decomposed organic material. The surface layer and subsoil typically are silt loam 1 to 8 inches (3 to 20 cm) thick. The substratum is calcareous gravelly clay loam. Permafrost occurs at 14 to 29 inches (36 to 74 cm) below the mineral soil surface.

The nearly level to gently sloping Chetaslina soils are very deep and well drained. The surface is covered with a thin mat of partially decomposed organic material. The mineral surface and subsoil typically are silt loam 1 to 8 inches (3 to 20 cm) thick. The substratum is calcareous gravelly loam.

Minor components in this unit include the somewhat excessively drained Pippin soils, the very poorly or poorly drained Tolsona and Klawasi soils, and muskegs.

The soils in this unit are mainly used for cropland, hayland and pastureland, forestland, and urban development.

The main limitations for all uses on Mendeltna soils are permafrost and perched water table.

The main limitations for forestland on Chetaslina soils are low bearing capacity and cold soil temperatures.

The main limitations for urban development include low load supporting capacity, restricted permeability, and frost heaving on Chetaslina soils.

The main limitations for cropland and hayland and pastureland on Chetaslina soils include frost heaving, wind erosion, water erosion, limited late spring precipitation, and frequent mid-summer frosts.

Tolsona-Tebay-Tsana Association

Shallow to moderately deep over permafrost, and very deep, very poorly to poorly drained, and well drained soils formed in a thin loess mantle over loamy glacial till material

This map unit occurs on glacial till plains. Slopes range from 0 to 20 percent. The vegetation is mainly black spruce and willow on Tolsona soils and quaking aspen, white spruce, and willow on Tebay and Tsana soils. Elevation ranges from 1300 to 2200 feet (396 to 670 m). Average annual precipitation is about 12 inches.

This map unit makes up about 20 percent of the survey area. Tolsona soils make up about 40 percent of the unit, Tebay soils about 25 percent, and Tsana soils about 25 percent. The remaining 10 percent are soils of minor extent.

The nearly level to moderately steep Tolsona soils are shallow to moderately deep over permafrost and very poorly or poorly drained. The surface is covered with a thick mat of fibrous and partially decomposed organic material. The surface and subsurface mineral layers are typically silt loam 1 to 8 inches (3 to 20 cm) thick. The substratum is gravelly sandy loam. Depth to permafrost ranges from 14 to 26 inches (36 to 66 cm).

The nearly level to moderately steep Tebay soils are very deep and well drained. The surface is covered with a thin mat of fibrous organic material. The surface and subsurface mineral layers are typically silt loam 1 to 8 inches (3 to 20 cm) thick. The substratum is gravelly sand.

The nearly level to moderately steep Tsana soils are very deep and well drained. The surface is covered with a thin mat of fibrous organic material. The surface and subsurface mineral layers are typically silt loam 1 to 8 inches (3 to 20 cm) thick. The substratum is gravelly sandy loam.

Minor components in this unit are very poorly drained Cryohemists and Cryofibrists in muskegs, the somewhat excessively drained Pippin soils on hills, and outwash plains.

The soils in this unit are mainly used for hayland and pastureland, forestland, urban development, and wildlife habitat.

The main limitations for all uses on Tolsona soils are permafrost and perched water table.

The main limitations for forestland on Tebay and Tsana soils are low load supporting capacity and cold soil temperatures.

The main limitations for urban development on Tebay and Tsana soils are frost heaving and restricted permeability.

The main limitations for cropland and hayland and pastureland on Tebay and Tsana soils are wind and water erosion, occasional surface boulders, limited late spring precipitation, and frequent mid-summer frost.

Copper River-Tonsina Association

Very shallow over permafrost and very deep, very poorly drained, and well drained soils formed in a silty loess mantle over glacial till

This map unit occurs on glacial till plains. Slopes are dominantly 0 to 20 percent. Elevation ranges from 1100 to 2000 feet (335 to 610 m).

This map unit makes up about 10 percent of the survey area. Copper River soils make up about 50 percent of the map unit and Tonsina soils about 35 percent. The remaining 15 percent are soils of minor extent.

The nearly level to moderately steep Copper River soils are very shallow to permafrost and very poorly drained. The surface is covered with a mat of fibrous and partially decomposed organic material. The mineral surface layer is typically silt loam. Permafrost occurs at a depth of 0 to 6 inches (0 to 15 cm).

The nearly level to moderately steep Tonsina soils are very deep and well drained. The surface is covered with a mat of partially decomposed organic material. The mineral surface layer and subsoil are typically silt loam ranging from 14 to 33 inches (36 to 91 cm) in thickness. The substratum is gravelly loam.

Minor components in this unit are the very poorly drained Wrangell soils, escarpments, the well drained Kenny Lake soils, and the somewhat excessively drained Pippin soils.

The soils in this unit are mainly used for forestland, urban development, cropland, hayland and pastureland, and wildlife habitat.

The main limitations for all uses on Copper River soils are permafrost and perched water table.

The main limitations for forestland on Tonsina soils are low load supporting capacity and cold soil temperatures.

The main limitations for urban development on Tonsina soils include frost heaving, load supporting capacity, and restricted permeability.

The main limitations for cropland and hayland and pastureland on Tonsina soils are frost heave, wind and water erosion, limited late spring precipitation, and frequent mid-summer frosts.

Copper River-Strelna-Hanagita Association

Very shallow over permafrost and shallow to bedrock, very poorly drained and well drained soils formed in silty loess over permafrost and dominantly andesite bedrock

This map unit occurs on hills. Slopes range from 10 to 55 percent. The vegetation is dominantly black spruce and willow on Copper River soils; white spruce and paper birch on Strelna soils; and willow, white spruce, and quaking aspen on Hanagita soils. Elevations range from 800 to 2100 feet (244 to 640 m). Average annual precipitation is about 12 inches (30 cm).

This map unit makes up about 10 percent of the survey area. Copper River soils make up about 35 percent of the map unit, Strelna soils about 30 percent, and Hanagita soils about 20 percent. The remaining 15 percent are soils of minor extent.

The moderately steep Copper River soils are very shallow to permafrost and very poorly drained. The surface is covered with a thick mat of fibrous and partially decomposed organic material. The mineral surface layer is typically silt loam. Depth to permafrost ranges from 0 to 6 inches (0 to 15 cm).

The steep Strelna soils are very shallow over permafrost and well drained. The surface is covered with a thick mat of fibrous and partially decomposed organic material. The mineral surface layer is typically mucky silt loam. Permafrost occurs at a depth of 0 to 10 inches (0 to 25 cm).

The moderately steep to steep Hanagita soils are shallow over consolidated andesite and limestone and well drained. The surface is covered with a thin mat of fibrous organic material. The mineral surface and subsurface layers are typically silt loam. The substratum is gravelly silt loam over andesite bedrock. Bedrock occurs at 12 to 20 inches (30 to 50 cm).

Minor components in this unit are the well drained Kenny Lake soils, the very poorly drained Cryohemists, and escarpments.

The soils in this unit are mainly used for forestland and wildlife habitat.

The main limitations for all uses include permafrost, slope, cold soil temperatures, low bearing capacity, perched water table, and wind and water erosion.

Detailed Soil Map Units

The map units delineated on the detailed maps at the back of this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses. More information about each map unit is given under the heading "Use and Management of the Soils" (page 145).

A map unit delineation on the detailed soil maps represents an area on the landscape and consists of one or more soils or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class, there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas are natural phenomena and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some "included" areas that belong to other taxonomic classes.

Most included soils have properties similar to those of the dominant soil or soils in the map unit, and, thus, they do not affect use and management. These are called noncontrasting, or similar, inclusions. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. They generally are in small areas and could not be mapped separately because of the scale used. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and, consequently, they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of included areas in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but if intensive use of small areas is planned, on-site investigation is needed to define and locate the soils and miscellaneous areas. An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series.* Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or the underlying layers. They also can differ in slope, stoniness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Copper River peat, 0 to 2 percent slopes, is one of several phases in the Copper River series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes and undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Strelna-Hanagita-Copper River complex, 15 to 55 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be

mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Cryorthents and Cryochrepts, 30 to 70 percent slopes, is an undifferentiated group in this survey area.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Badlands is an example.

This survey was mapped at two levels of detail. At the most detailed level, map units are narrowly defined. This means that map unit boundaries were plotted and verified at closely spaced intervals. At the less detailed level, map units are broadly defined. Boundaries were plotted and verified at wider intervals. The detail of mapping was selected to meet the anticipated long-term use of the survey, and the map units were designed to meet the needs for that use.

Table 5 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables," page viii) give properties of the soils and the limitations, capabilities, and potentials for many uses. The glossary (page 197) defines many of the terms used in describing the soils or miscellaneous areas.

Map Unit Descriptions

401—Badlands

Composition

Badlands: 100 percent

Characteristics of Badlands

Positions on landscape: lacustrine terraces
Microtopography: mineral springs (mud volcanoes)
Slope range: 10 to 30 percent
Slope features: plane to convex
Native vegetation: none
Material: silty and clayey textured deposits with a high content of salt crystals and moderately alkaline pH

402—Chistochina silt loam, 0 to 7 percent slopes

Composition

Chistochina silt loam and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Chistochina Soil

Positions on landscape: till plains
Microtopography: drumlins
Slope range: 0 to 7 percent
Slope features: plane or convex
Organic mat on surface: 1 to 4 inches (2 to 10 cm) thick
Native vegetation: white spruce, aspen, tall willow, low shrubs, and forbs

Typical profile:
*****0 to 1 inch (0 to 2 cm)—dark brown silt loam
*****1 to 8 inches (2 to 20 cm)—brown fine sandy loam
*****8 to 60 inches (20 to 152 cm)—dark brown loamy fine sand, very dark gray fine sand, and gravelly fine sand

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: somewhat excessively drained
Permeability: in the silty loess mantle—moderate; in the fine sandy loam subsoil—moderately rapid; below this—rapid
Available water capacity: low
Depth to contrasting fine sandy loam material: 1 to 3 inches (2 to 20 cm)
Depth to sandy outwash material: 3 to 15 inches (8 to 38 cm)
Runoff: slow
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in depressions with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*****soils in similar positions that have very gravelly textures
*****soils that have slopes of more than 7 percent

Major Uses

Current uses: wildlife habitat
Potential uses: homesteads

Major Management Factors

Soil-related factors: wind erosion, water erosion, and permeability
Elevation: 1400 to 2200 feet (427 to 670 m)

Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—60 to 80 days (28 degree base temperature)

Building Site Development

General management considerations:
*****Cutbanks are not stable and are subject to caving.
*****Excavation can expose soil material that is highly susceptible to wind erosion.
*****Excavation can increase the risk of water erosion.
*****The rapid permeability of the substratum may allow effluent from moderate or high density housing to pollute the ground water.
*****This unit is a good source of roadfill.

Suitable management practices:
*****Establish gently sloping grades on cutbanks and excavations and revegetate as soon as possible to reduce the risk of caving.
*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*****Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Limit the number of septic systems per area to avoid polluting the ground water.

403—Copper River peat, 0 to 2 percent slopes

Composition

Copper River peat and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Characteristics of Copper River Soil

Positions on landscape: stream terraces, broad lacustrine terraces, and till plains
Slope range: 0 to 2 percent
Slope features: plane
Organic mat on surface: 8 to 14 inches (20 to 36 cm) thick
Native vegetation: dwarf black and white spruce, tall alder, low and dwarf shrubs, and moss

Typical profile:
*****9 inches to 0 (23 cm to 0)—dark brown peat and black mucky peat consisting of fibrous and partially decomposed roots, moss, and twigs
*****0 to 3 inches (0 to 8 cm)—black, very dark brown, and dark brown silt loam
*****3 to 13 inches (8 to 33 cm)—perennially frozen black, dark brown, and very dark brown silt loam

Drainage class: very poorly drained
Permeability: in the organic mat—moderately rapid; in the mineral soil above the permafrost—moderate; in the permafrost—impermeable
Available water capacity: including organic mat—low
Root restricting feature: permafrost
Depth to permafrost: 0 to 10 inches (0 to 25 cm) below the surface of the mineral soil
Runoff: slow
Depth to perched water table: 0 to 10 inches (0 to 25 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in similar positions that lack thick organic mats, permafrost, and the associated perched water table within 40 inches (100 cm)
*****soils in muskegs that have over 16 inches (40 cm) of organic material overlying mineral soil
*****soils in similar positions with clayey, gravelly, or loamy textures within 10 inches (25 cm) of the mineral surface
*****soils with slopes greater than 2 percent

Major Uses

Current uses: homesteads and wildlife habitat
Potential uses: forestland, cropland, and hayland and pastureland

Major Management Factors

Soil-related factors: depth to permafrost, wind erosion, depth to perched water table, frost heaving, thermokarst, low fertility, and restricted permeability
Elevation: 1100 to 1400 feet (335 to 432 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—70 to 90 days (28 degree base temperature)

Cropland

With permafrost:
General management considerations:
*****Clearing large areas with obvious surface drainage

outlets results in thawing of the permafrost and subsequent lowering of the water table.
*Differential subsidence may occur where massive ice features are present.

Suitable management practices:
*Frozen substrata are variable and include silty, sandy and/or gravelly, clayey, or loamy materials. Conduct on-site investigations before clearing.
*Leave strips of trees as windbreaks when clearing.

When thawed:
General management considerations:
*Suitable crops for planting include climatically adapted vegetables, short season grain varieties, potatoes, and hay.
*Additional drainage may be necessary in areas where natural drainage outlets are absent.
*Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.
*Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*Crops respond well to fertilizer if precipitation is adequate.
*Occasional boulders on the surface may present a hazard to machinery.
*Small depressional areas comprise up to 10 percent of this unit, remain wet for extended periods in the spring, and may delay cultivation.

Suitable management practices:
*Use conservation tillage to conserve moisture.
*Rotate crops and use conservation tillage to maintain or improve soil fertility.
*Use shallow cuts when land smoothing to avoid exposing gravelly, sandy, clayey, or loamy substratum materials.
*Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*Conduct on-site investigations to determine if massive ice features are present.

Forestland

With permafrost:
Principal tree species are: dwarf black spruce and white spruce
Common understory plants are: Labrador tea ledum, alder, lowbush cranberry, prickly rose, black crowberry, bog blueberry, and moss
Mean site index and yields: not estimated—the presence of permafrost and the associated perched water table result in stunted growth and low site productivity

General management considerations:
*Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost, lowering of the water table, and increased site productivity.

When thawed:
Principal tree species are: white spruce and quaking aspen
Common understory plants are: tall willow, lowbush cranberry, prickly rose, soapberry, twinflower, pumpkinberry, and northern reedgrass

General management considerations:
*If soil drainage occurs after thawing, site productivity increases; however, variable substratum materials result in variations in site index values.
*On-site investigation is necessary to determine the nature of the substratum materials. Depending on the nature of the substratum materials found, refer to map units 407, 411, or 415 for applicable site index and yield information, and management considerations and practices.
*Productivity of maturing stands may decline significantly as the permafrost and associated water table rise within the soil profile.

Suitable management practices:
*Use conventional equipment in harvesting, but limit its use when the soil is wet.
*Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

With permafrost:
General management considerations:
*Excavation is hampered by permafrost.
*Excavation can expose material that is highly susceptible to wind erosion.
*Frost action limits construction of access roads, driveways, and buildings.
*Local roads may require a special base to prevent permafrost damage.
*Septic tank absorption fields can be expected to function poorly because of wetness and the limited depth to permafrost, which restrict the movement and infiltration of effluent.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.
*Construct buildings on thick gravel pads to reduce subsidence caused by the melting of permafrost.
*Leave the vegetation and organic mat intact where it is desirable to maintain the present level of permafrost.
*Underlay roads with gravel to minimize frost action.
*Clearing large areas with obvious surface drainage outlets results in the eventual subsidence of the permafrost and water table to below 60 inches (152 cm).

When thawed:
General management considerations:
*Excavation can expose material that is highly susceptible to wind erosion.
*Frost action limits construction of access roads, driveways, and buildings.
*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.
*Depressional areas that comprise up to 10 percent of this unit remain wet after clearing.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Provide drainage to reduce wetness if roads and buildings are to be constructed in depressional areas.
*Consider the depth to which annual frosts penetrate when designing footings and road bases.
*Conduct on-site investigations to determine whether the area considered for a septic tank absorption field is underlain by unsuitable material.
*Conduct on-site investigations to determine if massive ice features are present.
*Underlay roads with gravel to minimize frost action.

404—Copper River peat, 2 to 7 percent slopes

Composition

Copper River peat and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Characteristics of Copper River Soil

Positions on landscape: stream terraces, broad lacustrine terraces, and till plains
Slope range: 2 to 7 percent
Slope features: plane
Organic mat on surface: 8 to 14 inches (20 to 36 cm) thick
Native vegetation: dwarf black and white spruce, tall alder, low and dwarf shrubs, and moss

Typical profile:
*9 inches to 0 (23 cm to 0)—dark brown peat and black mucky peat consisting of fibrous and partially decomposed roots, moss, and twigs
*0 to 3 inches (0 to 8 cm)—black, very dark brown, and dark brown silt loam
*3 to 13 inches (8 to 33 cm)—perennially frozen black, dark brown, and very dark brown silt loam

Drainage class: very poorly drained
Permeability: in the organic mat—moderately rapid; in the mineral soil above the permafrost—moderate; in the permafrost—impermeable
Available water capacity: including organic mat—low
Root restricting feature: permafrost
Depth to permafrost: 0 to 10 inches (0 to 25 cm) below the surface of the mineral soil
Runoff: slow
Depth to perched water table: 0 to 10 inches (0 to 25 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in similar positions that lack thick organic mats, permafrost, and the associated perched water table within 40 inches (100 cm)
*soils in muskegs that have over 16 inches (40 cm) of organic material overlying mineral soil
*soils in similar positions with clayey, gravelly, or loamy textures within 10 inches (25 cm) of the mineral surface
*soils with slopes less than 2 percent or greater than 7 percent

Major Uses

Current uses: homesteads and wildlife habitat
Potential uses: forestland, cropland, and hayland and pastureland

Major Management Factors

Soil-related factors: depth to permafrost, wind erosion, water erosion, depth to perched water table, frost

heaving, thermokarst, low fertility, and restricted permeability
Elevation: 1100 to 1400 feet (335 to 432 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—70 to 90 days (28 degree base temperature)

Cropland

With permafrost:
General management considerations:
*****Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost and subsequent lowering of the water table.
*****Differential subsidence may occur where massive ice features are present.

Suitable management practices:
*****Frozen substrata are variable and include silty, sandy and/or gravelly, clayey, or loamy materials. Conduct on-site investigations before clearing.
*****Leave strips of trees as windbreaks when clearing.

When thawed:
General management considerations:
*****Suitable crops for planting include climatically adapted vegetables, short season grain varieties, potatoes, and hay.
*****Additional drainage may be necessary in areas where natural drainage outlets are absent.
*****Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.
*****Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*****Crops respond well to fertilizer if precipitation is adequate.
*****Occasional boulders on the surface may present a hazard to machinery.

Suitable management practices:
*****Use conservation tillage to conserve moisture.
*****Rotate crops and use conservation tillage to maintain or improve soil fertility.
*Shallow cuts are recommended during land smoothing to avoid exposing gravelly, sandy, clayey, or loamy substratum materials.
*****Maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*****Row crops should only be grown in rotation with hay and grain to reduce the risk of water erosion.
*****Cultivate and seed on the contour or across the slope and maintain crop residue on or near the surface to reduce the risk of water erosion.
*****Conduct on-site investigations to determine if massive ice features are present.

Forestland

With permafrost:
Principal tree species are: dwarf black spruce and white spruce
Common understory plants are: Labrador tea ledum, alder, lowbush cranberry, prickly rose, black crowberry, bog blueberry, and moss
Mean site index and yields: not estimated—the presence of permafrost and the associated perched water table result in stunted growth and low site productivity

General management considerations:
*****Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost, lowering of the water table, and increased site productivity.

When thawed:
Principal tree species are: white spruce and quaking aspen
Common understory plants are: tall willow, lowbush cranberry, prickly rose, soapberry, twinflower, pumpkinberry, and northern reedgrass

General management considerations:
*****If soil drainage occurs after thawing, site productivity increases; however, variable substratum materials result in variations in site index values.
*****On-site investigation is necessary to determine the nature of the substratum materials. Depending on the nature of the substratum materials found, refer to map units 408, 412, or 416 for applicable site index and yield information, and management considerations and practices.
*****Productivity of maturing stands may decline significantly as the permafrost and associated water table rise within the soil profile.

Suitable management practices:
*Use conventional equipment in harvesting, but limit its use when the soil is wet.
*Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commercial size and selectively cut mature trees to improve stands.

Building Site Development

With permafrost:

General management considerations:

*****Excavation is hampered by permafrost.
*****Excavation can expose material that is highly susceptible to wind erosion.
*****Excavation increases the risk of water erosion.
*****Frost action limits construction of access roads, driveways, and buildings.
*****Local roads may require a special base to prevent permafrost damage.
*****Septic tank absorption fields can be expected to function poorly because of wetness and the limited depth to permafrost, which restrict the movement and infiltration of effluent.

Suitable management practices:

*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*****Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.
*****Construct buildings on thick gravel pads to reduce subsidence caused by the melting of permafrost.
*****Leave the vegetation and organic mat intact where it is desirable to maintain the present level of permafrost.
*****Underlay roads with gravel to minimize frost action.
*****Clearing large areas with obvious surface drainage outlets results in the eventual subsidence of the permafrost and water table to below 60 inches (152 cm).

When thawed:

General management considerations:

*****Excavation increases the risk of water erosion.
*****Excavation can expose material that is highly susceptible to wind erosion.
*****Frost action limits construction of access roads, driveways, and buildings.
*****Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.

Suitable management practices:

*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*****Consider the depth to which annual frosts penetrate when designing footings and road bases.
*****Conduct on-site investigations to determine whether the area considered for a septic tank absorption field is underlain by unsuitable material.
*****Conduct on-site investigations to determine if massive ice features are present.
*****Underlay roads with gravel to minimize frost action.

405—Copper River peat, 7 to 12 percent slopes

Composition

Copper River peat and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Characteristics of Copper River Soil

Positions on landscape: stream terraces, broad lacustrine terraces, and till plains
Slope range: 7 to 12 percent
Slope features: plane
Organic mat on surface: 8 to 14 inches (20 to 36 cm) thick
Native vegetation: dwarf black and white spruce, tall alder, low and dwarf shrubs, and moss

Typical profile:

*****9 inches to 0 (23 cm to 0)—dark brown peat and black mucky peat consisting of fibrous and partially decomposed roots, moss, and twigs
*****0 to 3 inches (0 to 8 cm)—black, very dark brown, and dark brown silt loam
*****3 to 13 inches (8 to 33 cm)—perennially frozen black, dark brown, and very dark brown silt loam

Drainage class: very poorly drained
Permeability: in the organic mat—moderately rapid; in the mineral soil above the permafrost—moderate; in the permafrost—impermeable
Available water capacity: including organic mat—low
Root restricting feature: permafrost
Depth to permafrost: 0 to 10 inches (0 to 25 cm) below the surface of the mineral soil
Runoff: slow
Depth to perched water table: 0 to 10 inches (0 to 25 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in similar positions that lack thick organic mats, permafrost, and the associated perched water table within 40 inches (100 cm)
*****soils in muskegs that have over 16 inches (40 cm) of organic material overlying mineral soil
*****soils in similar positions with clayey, gravelly, or loamy textures within 10 inches (25 cm) of the mineral surface

***soils with slopes less than 7 percent or greater than 12 percent**

Major Uses

Current uses: homesteads and wildlife habitat
Potential uses: forestland and hayland and pastureland

Major Management Factors

Soil-related factors: depth to permafrost, wind erosion, water erosion, depth to perched water table, frost heaving, slope, thermokarst, low fertility, and restricted permeability
Elevation: 1100 to 1400 feet (335 to 432 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—70 to 90 days (28 degree base temperature)

Hayland and Pastureland

With permafrost:
General management considerations:
*****Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost and subsequent lowering of the water table.
*****Differential subsidence may occur where massive ice features are present.

Suitable management practices:
*****Frozen substrata are variable and include silty, sandy and/or gravelly, clayey, or loamy materials. Conduct on-site investigations before clearing.
*****Leave strips of trees as windbreaks when clearing.

When thawed:
General management considerations:
*****Additional drainage may be necessary in areas where natural drainage outlets are absent.
*****Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.
*****Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*****Hay crops respond well to fertilizer if precipitation is adequate.
*****Occasional boulders on the surface may present a hazard to machinery.

Suitable management practices:
*****Seed to permanent hay or pasture, cultivate and seed on the contour or across the slope, and leave native vegetation intact on steeper areas of this unit to reduce the risk of erosion.
*Use shallow cuts when land smoothing to avoid exposing gravelly, sandy, clayey, or loamy substratum materials.
*****Maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*****Conduct on-site investigations to determine if massive ice features are present.

Forestland

With permafrost:
Principal tree species are: dwarf black spruce and white spruce
Common understory plants are: Labrador tea ledum, alder, lowbush cranberry, prickly rose, black crowberry, and moss
Mean site index and yields: not estimated—the presence of permafrost and the associated perched water table result in stunted growth and low site productivity

General management considerations:
*****Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost, lowering of the water table, and increased site productivity.

When thawed:
Principal tree species are: white spruce and quaking aspen
Common understory plants are: tall willow, lowbush cranberry, prickly rose, soapberry, twinflower, pumpkinberry, and northern reedgrass

General management considerations:
*****Site productivity increases after thawing; however, variable substratum materials result in variations in site index values.
*****On-site investigation is necessary to determine the nature of the substratum materials. Depending on the nature of the substratum materials found, refer to map units 409, 413, or 417 for applicable site index and yield information, and management considerations and practices.
*****Productivity of maturing stands may decline significantly as the permafrost and associated water table rise within the soil profile.
Suitable management practices:
*Use conventional equipment in harvesting, but limit its use when the soil is wet.
*Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.

*Thin trees before they reach commercial size and selectively cut mature trees to improve stands.

Building Site Development

With permafrost:

General management considerations:

*Excavation is hampered by permafrost.
*Excavation can expose material that is highly susceptible to wind erosion.
*Excavation increases the risk of water erosion.
*Frost action limits construction of access roads, driveways, and buildings.
*Road cutbanks are subject to slumping.
*Local roads may require a special base to prevent permafrost damage.
*Septic tank absorption fields can be expected to function poorly because of wetness and the limited depth to permafrost, which restrict the movement and infiltration of effluent.

Suitable management practices:

*Design and construct buildings and access roads to compensate for the steepness of slope.
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.
*Construct buildings on thick gravel pads to reduce subsidence caused by the melting of permafrost.
*Locate roads in more gently sloping areas, and design drainage systems to minimize the risk of slumping.
*Leave the vegetation and organic mat intact where it is desirable to maintain the present level of permafrost.
*Underlay roads with gravel to minimize frost action.
*Clearing large areas with obvious surface drainage outlets results in the eventual subsidence of the permafrost and water table to below 60 inches (152 cm).

When thawed:

General management considerations:

*Excavation increases the risk of water erosion.
*Excavation can expose material that is highly susceptible to wind erosion.
*Frost action limits construction of access roads, driveways, and buildings.
*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.

Suitable management practices:

*Design and construct buildings and access roads to compensate for the steepness of slope.
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Consider the depth to which annual frosts penetrate when designing footings and road bases.
*Conduct on-site investigations to determine whether the area considered for a septic tank absorption field is underlain by unsuitable material.
*Install septic tank absorption lines in adjacent areas that are more nearly level.
*Conduct on-site investigations to determine if massive ice features are present.
*Underlay roads with gravel to minimize frost action.

406—Copper River peat, 12 to 20 percent slopes

Composition

Copper River peat and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Characteristics of Copper River Soil

Positions on landscape: hills, stream terraces, broad lacustrine terraces, and till plains
Slope range: 12 to 20 percent
Slope features: plane
Organic mat on surface: 8 to 14 inches (20 to 36 cm) thick
Native vegetation: dwarf black and white spruce, tall alder, low and dwarf shrubs, and moss

Typical profile:

*9 inches to 0 (23 cm to 0)—dark brown peat and black mucky peat consisting of fibrous and partially decomposed roots, moss, and twigs
*0 to 3 inches (0 to 8 cm)—black, very dark brown, and dark brown silt loam
*3 to 13 inches (8 to 33 cm)—perennially frozen black, dark brown, and very dark brown silt loam

Drainage class: very poorly drained
Permeability: in the organic mat—moderately rapid; in the mineral soil above the permafrost—moderate; in the permafrost—impermeable
Available water capacity: including organic mat—low
Root restricting feature: permafrost
Depth to permafrost: 0 to 10 inches (0 to 25 cm) below the surface of the mineral soil
Runoff: medium
Depth to perched water table: 0 to 10 inches (0 to 25 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is

removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in similar positions that lack thick organic mats, permafrost, and the associated perched water table within 40 inches (100 cm)
*****soils in muskegs that have over 16 inches (40 cm) of organic material overlying mineral soil
*****soils in similar positions with clayey, gravelly, or loamy textures within 10 inches (25 cm) of the mineral surface
*****soils with slopes less than 12 percent or greater than 20 percent

Major Uses

Current uses: wildlife habitat
Potential uses: forestland

Major Management Factors

Soil-related factors: depth to permafrost, wind erosion, water erosion, depth to perched water table, frost heaving, slope, thermokarst, low fertility, and restricted permeability
Elevation: 1100 to 1400 feet (335 to 432 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—70 to 90 days (28 degree base temperature)

Forestland

With permafrost:
Principal tree species are: black spruce and white spruce
Common understory plants are: Labrador tea ledum, alder, lowbush cranberry, prickly rose, pumpkinberry, and moss
Mean site index and yields: not estimated—the presence of permafrost and the associated perched water table result in stunted growth and low site productivity

General management considerations:
*****Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost, lowering of the water table, and increased site productivity.

When thawed:
Principal tree species are: white spruce and paper birch
Common understory plants are: tall willow, alder, lowbush cranberry, prickly rose, pumpkinberry, and northern reedgrass

General management considerations:
*****Site productivity increases after thawing; however, variable substratum materials result in variations in site index values.
*****On-site investigation is necessary to determine the nature of the substratum materials. Depending on the nature of the substratum materials found, refer to map units 410, 414, or 418 for applicable site index and yield information, and management considerations and practices.
*****Productivity of maturing stands may decline significantly as the permafrost and associated water table rise within the soil profile.

Suitable management practices:
*Use conventional equipment in harvesting, but limit its use when the soil is wet.
*Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commercial size and selectively cut mature trees to improve stands.

407—Kenny Lake silt loam, 0 to 2 percent slopes

Composition

Kenny Lake silt loam and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Characteristics of Kenny Lake Soil

Positions on landscape: broad lacustrine terraces
Slope range: 0 to 2 percent
Slope features: plane
Organic mat on surface: 1 to 5 inches (3 to 13 cm) thick
Native vegetation: white spruce, aspen, tall willow, low shrubs, and herbs

Typical profile:
*****0 to 5 inches (0 to 12 cm)—grayish brown silt loam with streaks of very dark brown and very dark grayish brown
*****5 to 24 inches (12 to 60 cm)—grayish brown and olive gray silt loam and very fine sandy loam

*24 to 60 inches (60 to 152 cm)—olive gray silty clay loam and silty clay

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: moderate
Depth to contrasting clayey material: 16 to 27 inches (40 to 69 cm)
Runoff: slow
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in similar positions and muskegs with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*soils in similar positions that have clayey or gravelly material at less than 10 inches (25 cm)
*soils on convex slopes that have loamy glacial till material at less than 10 inches (25 cm)
*soils that have slopes of more than 2 percent

Major Uses

Current uses: cropland, hayland and pastureland, homesteads, and wildlife habitat
Potential uses: forestland

Major Management Factors

Soil-related factors: wind erosion, frost heaving, load supporting capacity, restricted permeability, and low fertility
Elevation: 900 to 1400 feet (274 to 432 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*soil temperature—30 to 32 °F (-1 to 0 °C) in forested areas and 32 to 35 °F (0 to 2 °C) in cultivated fields *(United States Department of Agriculture 1990)*
*frost-free period—70 to 90 days (28 degree base temperature)

Cropland

General management considerations:
*Suitable crops for planting are climatically adapted vegetables, short season grain varieties, potatoes, and hay.
*Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*Crops respond well to fertilizer if precipitation is adequate.
*Small depressional areas comprise up to 10 percent of this unit. These remain wet for extended periods in the spring and may delay cultivation.
*Occasional boulders and cobbles may present a hazard to machinery.
*Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.

Suitable management practices:
*Use conservation tillage to conserve moisture.
*Use shallow cuts when land smoothing to avoid exposing clayey material.
*Rotate crops and use conservation tillage to maintain or improve soil fertility.
*Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*Leave strips of trees as windbreaks when clearing.
*Conduct on-site investigations to determine if massive ice features are present.

Forestland

Principal tree species are: white spruce and quaking aspen
Common understory plants are: tall willow, highbush cranberry, prickly rose, soapberry, twinflower, pumpkinberry, and moss
Mean site index (100 year site curve) for stated species (and source): white spruce—77 *(Farr 1967),* based on a sample of 30 trees in 6 plots
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—1500 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—3050 cubic feet/acre *(Farr 1967)*

General management considerations:
*Productivity of maturing stands may decline significantly as the permafrost and associated water table rise within the soil profile.
*Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*Logging roads may require ballast.
*The upper 60 inches (152 cm) or more of soil have low bearing capacity and are poor road building material.

*If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*Because cold soil temperatures restrict roots, trees are moderately subject to windthrow.
*Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*Trees suitable for planting are white spruce.

Suitable management practices:
*Use conventional equipment in harvesting, but limit its use when the soil is wet.
*Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

General management considerations:
*Excavation can expose soil material that is highly susceptible to wind erosion.
*Frost action limits construction of access roads, driveways, and buildings.
*Septic tank absorption fields may function poorly because of degraded soil structure and reduced permeability upon addition of effluent.
*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Consider the depth to which annual frosts penetrate in designing footings and road bases.
*Increase the size of the septic absorption area to compensate for the restricted permeability.
*Conduct on-site investigations to determine if massive ice features are present.
*Underlay roads with gravel to minimize frost action.

408—Kenny Lake silt loam, 2 to 7 percent slopes

Composition

Kenny Lake silt loam and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Kenny Lake Soil

Positions on landscape: broad lacustrine terraces
Slope range: 2 to 7 percent
Slope features: plane
Organic mat on surface: 1 to 5 inches (3 to 13 cm) thick
Native vegetation: white spruce, aspen, tall willow, low shrubs, and herbs

Typical profile:
*0 to 5 inches (0 to 12 cm)—grayish brown silt loam with streaks of very dark brown and very dark grayish brown
*5 to 24 inches (12 to 60 cm)—grayish brown and olive gray silt loam and very fine sandy loam
*24 to 60 inches (60 to 152 cm)—olive gray silty clay loam and silty clay

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: moderate
Depth to contrasting clayey material: 16 to 27 inches (40 to 69 cm)
Runoff: slow
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in similar positions and muskegs with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*soils in similar positions that have clayey or gravelly material at less than 10 inches (25 cm)
*soils on convex slopes that have loamy glacial till material at less than 10 inches (25 cm)
*soils that have slopes of less than 2 percent or more than 7 percent

Major Uses

Current uses: cropland, hayland and pastureland, homesteads, and wildlife habitat
Potential uses: forestland

Major Management Factors

Soil-related factors: wind erosion, water erosion, frost heaving, load supporting capacity, restricted permeability, and low fertility
Elevation: 900 to 1400 feet (274 to 432 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)

*soil temperature—30 to 32 °F (-1 to 0 °C) in forested areas and 32 to 35 °F (0 to 2 °C) in cultivated fields *(United States Department of Agriculture 1990)*
*frost-free period—70 to 90 days (28 degree base temperature)

Cropland

General management considerations:
*Suitable crops for planting are climatically adapted vegetables, short season grain varieties, potatoes, and hay.
*Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*Crops respond well to fertilizer if precipitation is adequate.
*Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.

Suitable management practices:
*Use conservation tillage and farm on the contour to conserve moisture.
*Use shallow cuts when land smoothing to avoid exposing clayey material.
*Rotate crops and use conservation tillage to maintain or improve soil fertility.
*Cultivate and seed on the contour or across the slope and maintain crop residue on or near the surface to reduce the risk of water erosion.
*Grow row crops in rotation with hay and grain to reduce the hazard of water erosion.
*Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*Leave strips of trees as windbreaks when clearing.
*Conduct on-site investigations to determine if massive ice features are present.

Forestland

Principal tree species are: white spruce and quaking aspen
Common understory plants are: tall willow, highbush cranberry, prickly rose, soapberry, twinflower, pumpkinberry, and moss
Mean site index (100 year site curve) for stated species (and source): white spruce—77 *(Farr 1967),* based on a sample of 30 trees in 6 plots
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—1500 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—3050 cubic feet/acre *(Farr 1967)*

General management considerations:
*Productivity of maturing stands may decline significantly as the permafrost and associated water table rise within the soil profile.
*Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*Logging roads may require ballast.
*The upper 60 inches (152 cm) or more of soil have low bearing capacity and are poor road building material.
*If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*Because cold soil temperatures restrict roots, trees are moderately subject to windthrow.
*Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*Trees suitable for planting are white spruce.

Suitable management practices:
*Use conventional equipment in harvesting, but limit its use when the soil is wet.
*Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

General management considerations:
*Excavation can expose soil material that is highly susceptible to wind erosion.
*Excavation increases the risk of water erosion.
*Frost action limits construction of access roads, driveways, and buildings.
*Septic tank absorption fields may function poorly because of degraded soil structure and reduced permeability upon addition of effluent.
*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Consider the depth to which annual frosts penetrate in designing footings and road bases.
*Increase the size of the septic absorption area to compensate for the restricted permeability.
*Conduct on-site investigations to determine if massive ice features are present.
*Underlay roads with gravel to minimize frost action.

409—Kenny Lake silt loam, 7 to 12 percent slopes

Composition

Kenny Lake silt loam and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Characteristics of Kenny Lake Soil

Positions on landscape: broad lacustrine terraces
Slope range: 7 to 12 percent
Slope features: plane
Organic mat on surface: 1 to 5 inches (3 to 13 cm) thick
Native vegetation: white spruce, aspen, tall willow, low shrubs, and herbs

Typical profile:
*****0 to 5 inches (0 to 12 cm)—grayish brown silt loam with streaks of very dark brown and very dark grayish brown
*****5 to 24 inches (12 to 60 cm)—grayish brown and olive gray silt loam and very fine sandy loam
*****24 to 60 inches (60 to 152 cm)—olive gray silty clay loam and silty clay

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: moderate
Depth to contrasting clayey material: 16 to 27 inches (40 to 69 cm)
Runoff: medium
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in similar positions and muskegs with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*****soils in similar positions that have clayey or gravelly material at less than 10 inches (25 cm)
*****soils on convex slopes that have loamy glacial till material between 10 and 40 inches (25 and 100 cm)
*****soils that have slopes of less than 7 percent or more than 12 percent

Major Uses

Current uses: homesteads and wildlife habitat
Potential uses: hayland and pastureland and forestland

Major Management Factors

Soil-related factors: slope, wind erosion, water erosion, frost heaving, load supporting capacity, restricted permeability, and low fertility
Elevation: 900 to 1400 feet (274 to 432 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****soil temperature—30 to 32 °F (-1 to 0 °C) in forested areas and 32 to 35 °F (0 to 2 °C) in cultivated fields *(United States Department of Agriculture 1990)*
*****frost-free period—70 to 90 days (28 degree base temperature)

Hayland and Pastureland

General management considerations:
*****Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*****Hay crops respond well to fertilizer if precipitation is adequate.
*Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.

Suitable management practices:
*****Steep slopes limit suitable crops to permanent hay and pasture.
*****Use conservation tillage to conserve moisture.
*Use shallow cuts when land smoothing to avoid exposing clayey material.
*****Seed to permanent hay or pasture, cultivate or seed on the contour or across the slope, and leave native vegetation intact on steeper areas of the unit to reduce the risk of water erosion.
*****Maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*****Leave strips of trees as windbreaks when clearing.
*****Conduct on-site investigations to determine if massive ice features are present.

Forestland

Principal tree species are: white spruce and quaking aspen

Common understory plants are: tall willow, highbush cranberry, prickly rose, soapberry, twinflower, pumpkinberry, and moss
Mean site index (100 year site curve) for stated species (and source): white spruce—77 *(Farr 1967),* based on a sample of 30 trees in 6 plots
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—1500 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—3050 cubic feet/acre *(Farr 1967)*

General management considerations:
*****Productivity of maturing stands may decline significantly as the permafrost and associated water table rise within the soil profile.
*****Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*****Logging roads may require ballast.
*****Adequately designed drainage systems reduce the risk of concentrated flow erosion on roadways.
*****The upper 60 inches (152 cm) or more of soil have low bearing capacity and are poor road building material.
*****If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*****Because cold soil temperatures restrict roots, trees are moderately subject to windthrow.
*****Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*****Trees suitable for planting are white spruce.

Suitable management practices:
*****Use conventional equipment in harvesting, but limit its use when the soil is wet.
*****Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*****Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

General management considerations:
*****Excavation can expose soil material that is highly susceptible to wind erosion.
*****Excavation increases the risk of water erosion.
*****Frost action limits construction of access roads, driveways, and buildings.
*****Septic tank absorption fields may function poorly because of degraded soil structure and reduced permeability upon addition of effluent.
*****Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.

Suitable management practices:
*****Design and construct buildings and access roads to compensate for steepness of slope.
*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*****Consider the depth to which annual frosts penetrate in designing footings and road bases.
*Increase the size of the septic absorption area to compensate for the restricted permeability.
*****Conduct on-site investigations to determine if massive ice features are present.
*****Underlay roads with gravel to minimize frost action.

410—Kenny Lake silt loam, 12 to 20 percent slopes

Composition

Kenny Lake silt loam and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Kenny Lake Soil

Positions on landscape: broad lacustrine terraces
Microtopography: escarpments and hills
Slope range: 12 to 20 percent
Slope features: plane
Organic mat on surface: 1 to 5 inches (3 to 13 cm) thick
Native vegetation: white spruce, aspen, tall willow, low shrubs, and herbs

Typical profile:
*****0 to 5 inches (0 to 12 cm)—grayish brown silt loam with streaks of very dark brown and very dark grayish brown
*****5 to 24 inches (12 to 60 cm)—grayish brown and olive gray silt loam and very fine sandy loam
*****24 to 60 inches (60 to 152 cm)—olive gray silty clay loam and silty clay

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: moderate
Depth to contrasting clayey material: 16 to 27 inches (40 to 69 cm)
Runoff: medium
Hazard of erosion: by water—slight if the organic mat is not removed, severe if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in similar positions and muskegs with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*soils in similar positions that have clayey or gravelly material at less than 10 inches (25 cm)
*soils on convex slopes that have loamy glacial till material at less than 10 inches (25 cm)
*soils that have slopes of less than 12 percent or more than 20 percent

Major Uses

Current uses: wildlife habitat
Potential uses: forestland

Major Management Factors

Soil-related factors: slope, wind erosion, water erosion, frost heaving, load supporting capacity, restricted permeability, and low fertility
Elevation: 900 to 1400 feet (274 to 432 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*frost-free period—70 to 90 days (28 degree base temperature)

Forestland

Principal tree species are: white spruce and quaking aspen
Common understory plants are: tall willow, highbush cranberry, prickly rose, soapberry, twinflower, pumpkinberry, and moss
Mean site index (100 year site curve) for stated species (and source): white spruce—77 *(Farr 1967),* based on a sample of 30 trees in 6 plots
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—1500 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—3050 cubic feet/acre *(Farr 1967)*

General management considerations:
*Productivity of maturing stands may decline significantly as the permafrost and associated water table rise within the soil profile.
*The main limitation for the harvesting of timber is slope.
*Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*Logging roads may require ballast.
*Adequately designed drainage systems reduce the risk of concentrated flow erosion on roadways.
*The upper 60 inches (152 cm) or more of soil have low bearing capacity and are poor road building material.
*If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*Because cold soil temperatures restrict roots, trees are moderately subject to windthrow.
*Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*Trees suitable for planting are white spruce.

Suitable management practices:
*Use conventional equipment in harvesting, but limit its use when the soil is wet.
*Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

411—Chitina silt loam, 0 to 2 percent slopes

Composition

Chitina silt loam and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Chitina Soil

Positions on landscape: broad lacustrine terraces and high stream terraces
Slope range: 0 to 2 percent
Slope features: plane
Organic mat on surface: 1 to 5 inches (3 to 13 cm) thick
Native vegetation: white spruce, aspen, tall willow, low shrubs, and herbs

Typical profile:
*0 to 2 inches (0 to 5 cm)—very dark grayish brown and dark brown silt loam
*2 to 32 inches (5 to 81 cm)—streaked colors dominated by dark grayish brown through strong brown silt loam and very fine sandy loam
*32 to 50 inches (81 to 127 cm)—streaked colors dominated by very dark grayish brown through dark gray very fine sandy loam
*50 to 60 inches (127 to 152 cm)—dark gray silty clay

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained

Permeability: moderate
Available water capacity: high
Depth to contrasting clayey material: 40 to over 60 inches (100 to over 152 cm)
Runoff: slow
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in similar positions and muskegs with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*****soils in similar positions that have clayey or gravelly material at less than 40 inches (100 cm)
*****soils that have slopes of more than 2 percent

Major Uses

Current uses: cropland, hayland and pastureland, homesteads, and wildlife habitat
Potential uses: forestland

Major Management Factors

Soil-related factors: wind erosion, frost heaving, load supporting capacity, restricted permeability, and low fertility
Elevation: 900 to 1400 feet (274 to 432 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****soil temperature—30 to 32 °F (-1 to 0 °C) in forested areas and 32 to 35 °F (0 to 2 °C) in cultivated fields *(United States Department of Agriculture 1990)*
*****frost-free period—70 to 90 days (28 degree base temperature)

Cropland

General management considerations:
*****Suitable crops for planting are climatically adapted vegetables, short season grain varieties, potatoes, and hay.
*****Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*****Crops respond well to fertilizer if precipitation is adequate.
*****Small depressional areas comprise up to 10 percent of this unit. These remain wet for extended periods in the spring and may delay cultivation.
*Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.

Suitable management practices:
*****Use conservation tillage to conserve moisture.
*****Rotate crops and use conservation tillage to maintain or improve soil fertility.
*****Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*****Leave strips of trees as windbreaks when clearing.
*****Conduct on-site investigations to determine if massive ice features are present.

Forestland

Principal tree species are: white spruce and quaking aspen
Common understory plants are: tall willow, highbush cranberry, prickly rose, twinflower, pumpkinberry, and moss
Mean site index (100 year site curve) for stated species (and source): white spruce—64 *(Farr 1967),* based on a sample of 27 trees in 5 plots
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—550 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2050 cubic feet/acre *(Farr 1967)*

General management considerations:
*****Productivity of maturing stands may decline significantly as the permafrost and associated water table rise within the soil profile.
*****Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*****Logging roads may require ballast.
*****The upper 60 inches (152 cm) or more of soil have low bearing capacity and are poor road building material.
*****If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*****Because cold soil temperatures restrict roots, trees are moderately subject to windthrow.
*****Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*****Trees suitable for planting are white spruce.

Suitable management practices:
*****Use conventional equipment in harvesting, but limit its use when the soil is wet.

*Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

General management considerations:
*Excavation can expose soil material that is highly susceptible to wind erosion.
*Frost action limits construction of access roads, driveways, and buildings.
*Septic tank absorption fields may function poorly because of the restricted permeability of the soil.
*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.
*Cut banks are not stable and are subject to caving.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Consider the depth to which annual frosts penetrate in designing footings and road bases.
*Increase the size of the septic absorption area to compensate for the restricted permeability.
*Conduct on-site investigations to determine if massive ice features are present.
*Underlay roads with gravel to minimize frost action.
*Establish gently sloping grades on cutbanks and excavations and revegetate as soon as possible to reduce the risk of caving.

412—Chitina silt loam, 2 to 7 percent slopes

Composition

Chitina silt loam and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Chitina Soil

Positions on landscape: broad lacustrine terraces and high stream terraces
Slope range: 2 to 7 percent
Slope features: plane
Organic mat on surface: 1 to 5 inches (3 to 13 cm) thick
Native vegetation: white spruce, aspen, tall willow, low shrubs, and herbs

Typical profile:
*0 to 2 inches (0 to 5 cm)—very dark grayish brown and dark brown silt loam
*2 to 32 inches (5 to 81 cm)—streaked colors dominated by dark grayish brown through strong brown very fine sandy loam
*32 to 50 inches (81 to 127 cm)—streaked colors dominated by very dark grayish brown through dark gray very fine sandy loam
*50 to 60 inches (127 to 152 cm)—dark gray silty clay

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: high
Depth to contrasting clayey material: 40 to over 60 inches (100 to over 152 cm)
Runoff: slow
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in similar positions and muskegs with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*soils in similar positions that have clayey or gravelly material at less than 40 inches (100 cm)
*soils that have slopes of less than 2 percent or more than 7 percent

Major Uses

Current uses: cropland, hayland and pastureland, homesteads, and wildlife habitat
Potential uses: forestland

Major Management Factors

Soil-related factors: wind erosion, water erosion, frost heaving, load supporting capacity, restricted permeability, and low fertility
Elevation: 900 to 1400 feet (274 to 432 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*soil temperature—30 to 32 °F (-1 to 0 °C) in forested areas and 32 to 35 °F (0 to 2 °C) in cultivated fields *(United States Department of Agriculture 1990)*
*frost-free period—70 to 90 days (28 degree base temperature)

Cropland

General management considerations:

*****Suitable crops for planting are climatically adapted vegetables, short season grain varieties, potatoes, and hay.

*****Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.

*****Crops respond well to fertilizer if precipitation is adequate.

*Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.

Suitable management practices:

*****Use conservation tillage and farm on the contour to conserve moisture.

*****Rotate crops and use conservation tillage to maintain or improve soil fertility.

*****Cultivate and seed on the contour or across the slope and maintain crop residue on or near the surface to reduce the risk of water erosion.

*****Grow row crops in rotation with hay and grain to reduce the hazard of water erosion.

*****Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.

*****Leave strips of trees as windbreaks when clearing.

*****Conduct on-site investigations to determine if massive ice features are present.

Forestland

Principal tree species are: white spruce and quaking aspen

Common understory plants are: tall willow, highbush cranberry, prickly rose, twinflower, pumpkinberry, and moss

Mean site index (100 year site curve) for stated species (and source): white spruce—64 *(Farr 1967),* based on a sample of 27 trees in 5 plots

Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—550 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2050 cubic feet/acre *(Farr 1967)*

General management considerations:

*****Productivity of maturing stands may decline significantly as the permafrost and associated water table rise within the soil profile.

*****Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.

*****Logging roads may require ballast.

*****The upper 60 inches (152 cm) or more of soil have low bearing capacity and are poor road building material.

*****If seed trees are in the stand, reforestation occurs naturally in cutover areas.

*****Because cold soil temperatures restrict roots, trees are moderately subject to windthrow.

*****Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.

*****Trees suitable for planting are white spruce.

Suitable management practices:

*****Use conventional equipment in harvesting, but limit its use when the soil is wet.

*****Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.

*****Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

General management considerations:

*****Excavation can expose soil material that is highly susceptible to wind erosion.

*****Excavation increases the risk of water erosion.

*****Frost action limits construction of access roads, driveways, and buildings.

*****Septic tank absorption fields may function poorly because of the restricted permeability of the soil.

*****Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.

*Cut banks are not stable and are subject to caving.

Suitable management practices:

*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.

*****Consider the depth to which annual frosts penetrate in designing footings and road bases.

*Increase the size of the septic absorption area to compensate for the restricted permeability.

*****Conduct on-site investigations to determine if massive ice features are present.

*****Underlay roads with gravel to minimize frost action.

*Establish gently sloping grades on cutbanks and excavations and revegetate as soon as possible to reduce the risk of caving.

413—Chitina silt loam, 7 to 12 percent slopes

Composition

Chitina silt loam and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Characteristics of Chitina Soil

Positions on landscape: broad lacustrine terraces and high stream terraces
Slope range: 7 to 12 percent
Slope features: plane
Organic mat on surface: 1 to 5 inches (3 to 13 cm) thick
Native vegetation: white spruce, aspen, tall willow, low shrubs, and herbs

Typical profile:
*****0 to 2 inches (0 to 5 cm)—very dark grayish brown and dark brown silt loam
*****2 to 32 inches (5 to 81 cm)—streaked colors dominated by dark grayish brown through strong brown very fine sandy loam
*****32 to 50 inches (81 to 127 cm)—streaked colors dominated by very dark grayish brown through dark gray very fine sandy loam
*****50 to 60 inches (127 to 152 cm)—dark gray silty clay

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: high
Depth to contrasting clayey material: 40 to over 60 inches (100 to over 152 cm)
Runoff: medium
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in similar positions and muskegs with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*****soils in similar positions that have clayey or gravelly material at less than 40 inches (100 cm)
*****soils that have slopes of less than 7 percent or more than 12 percent

Major Uses

Current uses: homesteads and wildlife habitat
Potential uses: hayland and pastureland and forestland

Major Management Factors

Soil-related factors: slope, wind erosion, water erosion, frost heaving, load supporting capacity, restricted permeability, and low fertility
Elevation: 900 to 1400 feet (274 to 432 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****soil temperature—30 to 32 °F (-1 to 0 °C) in forested areas and 32 to 35 °F (0 to 2 °C) in cultivated fields *(United States Department of Agriculture 1990)*
*****frost-free period—70 to 90 days (28 degree base temperature)

Hayland and Pastureland

General management considerations:
*****Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*****Hay crops respond well to fertilizer if precipitation is adequate.
*Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.

Suitable management practices:
*****Steep slopes limit suitable crops to permanent hay and pasture.
*****Use conservation tillage to conserve moisture.
*****Seed to permanent hay or pasture, cultivate or seed on the contour or across the slope, and leave native vegetation intact on steeper areas of the unit to reduce the risk of water erosion.
*****Maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*****Leave strips of trees as windbreaks when clearing.
*****Conduct on-site investigations to determine if massive ice features are present.

Forestland

Principal tree species are: white spruce and quaking aspen

Common understory plants are: tall willow, highbush cranberry, prickly rose, twinflower, pumpkinberry, and moss
Mean site index (100 year site curve) for stated species (and source): white spruce—64 *(Farr 1967),* based on a sample of 27 trees in 5 plots
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—550 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2050 cubic feet/acre *(Farr 1967)*

General management considerations:
*****Productivity of maturing stands may decline significantly as the permafrost and associated water table rise within the soil profile.
*****Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*****Logging roads may require ballast.
*****Adequately designed drainage systems reduce the risk of concentrated flow erosion on roadways.
*****The upper 60 inches (152 cm) or more of soil have low bearing capacity and are poor road building material.
*****If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*****Because cold soil temperatures restrict roots, trees are moderately subject to windthrow.
*****Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*****Trees suitable for planting are white spruce.

Suitable management practices:
*****Use conventional equipment in harvesting, but limit its use when the soil is wet.
*****Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*****Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

General management considerations:
*****Excavation can expose soil material that is highly susceptible to wind erosion.
*****Excavation increases the risk of water erosion.
*****Frost action limits construction of access roads, driveways, and buildings.
*****Septic tank absorption fields may function poorly because of degraded soil structure and reduced permeability upon addition of effluent.
*****Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.
*Cut banks are not stable and are subject to caving.

Suitable management practices:
*****Design and construct buildings and access roads to compensate for steepness of slope.
*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*****Consider the depth to which annual frosts penetrate in designing footings and road bases.
*****Install septic absorption lines in adjacent areas that are more nearly level.
*Increase the size of the septic absorption area to compensate for the restricted permeability.
*****Conduct on-site investigations to determine if massive ice features are present.
*****Underlay roads with gravel to minimize frost action.
*Establish gently sloping grades on cutbanks and excavations and revegetate as soon as possible to reduce the risk of caving.

414—Chitina silt loam, 12 to 20 percent slopes

Composition

Chitina silt loam and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Chitina Soil

Positions on landscape: broad lacustrine terraces and stream terraces
Microtopography: escarpments and sideslopes
Slope range: 12 to 20 percent
Slope features: plane
Organic mat on surface: 1 to 5 inches (3 to 13 cm) thick
Native vegetation: white spruce, aspen, tall willow, low shrubs, and herbs

Typical profile:
*****0 to 2 inches (0 to 5 cm)—very dark grayish brown and dark brown silt loam
*****2 to 32 inches (5 to 81 cm)—streaked colors dominated by dark grayish brown through strong brown very fine sandy loam
*****32 to 50 inches (81 to 127 cm)—streaked colors dominated by very dark grayish brown through dark gray very fine sandy loam
*****50 to 60 inches (127 to 152 cm)—dark gray silty clay

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: moderate

Available water capacity: high
Depth to contrasting clayey material: 40 to over 60 inches (100 to over 152 cm)
Runoff: medium
Hazard of erosion: by water—slight if the organic mat is not removed, severe if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in similar positions and muskegs with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*****soils in similar positions that have clayey or gravelly material at less than 40 inches (100 cm)
*****soils that have slopes of less than 12 percent or more than 20 percent

Major Uses

Current uses: wildlife habitat
Potential uses: forestland

Major Management Factors

Soil-related factors: slope, wind erosion, water erosion, frost heaving, load supporting capacity, restricted permeability, and low fertility
Elevation: 900 to 1400 feet (274 to 432 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—70 to 90 days (28 degree base temperature)

Forestland

Principal tree species are: white spruce, paper birch, and quaking aspen
Common understory plants are: tall willow, highbush cranberry, prickly rose, twinflower, pumpkinberry, and moss
Mean site index (100 year site curve) for stated species (and source): white spruce—64 *(Farr 1967),* based on a sample of 27 trees in 5 plots
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—550 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2050 cubic feet/acre *(Farr 1967)*

General management considerations:
*****Productivity of maturing stands may decline significantly as the permafrost and associated water table rise within the soil profile.
*****The main limitation for the harvesting of timber is slope.
*****Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*****Logging roads may require ballast.
*****Adequately designed drainage systems reduce the risk of concentrated flow erosion on roadways.
*****The upper 60 inches (152 cm) or more of soil have low bearing capacity and are poor road building material.
*****If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*****Because cold soil temperatures restrict roots, trees are moderately subject to windthrow.
*****Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*****Trees suitable for planting are white spruce.

Suitable management practices:
*****Use conventional equipment in harvesting, but limit its use when the soil is wet.
*****Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*****Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

415—Tonsina silt loam, 0 to 2 percent slopes

Composition

Tonsina silt loam and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Tonsina Soil

Positions on landscape: drumlins and till plains
Slope range: 0 to 2 percent
Slope features: plane to convex
Organic mat on surface: 2 to 5 inches (5 to 13 cm) thick
Native vegetation: white spruce, aspen, tall willow, low shrubs, and herbs

Typical profile:
*****0 to 15 inches (0 to 38 cm)—very dark grayish brown and dark brown silt loam

*15 to 60 inches (38 to 152 cm)—very dark grayish brown, dark gray, and gray sandy loam, fine sandy loam, and gravelly sandy loam

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: moderate
Depth to contrasting till material: 15 to 33 inches (38 to 91 cm)
Runoff: slow
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in similar positions and muskegs with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*soils in similar positions that have clayey, loamy, very gravelly, or sandy material at less than 10 inches (25 cm)
*soils that have slopes of more than 2 percent

Major Uses

Current uses: cropland, hayland and pastureland, homesteads, and wildlife habitat
Potential uses: forestland

Major Management Factors

Soil-related factors: wind erosion, frost heaving, load supporting capacity, restricted permeability, and low fertility
Elevation: 1000 to 1500 feet (305 to 457 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*frost-free period—70 to 90 days (28 degree base temperature)

Cropland

General management considerations:
*Suitable crops for planting are climatically adapted vegetables, short season grain varieties, potatoes, and hay.
*Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*Crops respond well to fertilizer if precipitation is adequate.
*Small depressional areas comprise up to 10 percent of this unit. These remain wet for extended periods in the spring and may delay cultivation.
*Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.

Suitable management practices:
*Use conservation tillage to conserve moisture.
*Rotate crops and use conservation tillage to maintain or improve soil fertility.
*Use shallow cuts when land smoothing to avoid exposing gravelly or cobbly till material.
*Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*Leave strips of trees as windbreaks when clearing.
*Conduct on-site investigations to determine if massive ice features are present.

Forestland

Principal tree species are: white spruce and quaking aspen
Common understory plants are: tall willow, highbush cranberry, prickly rose, soapberry, twinflower, pumpkinberry, and moss
Mean site index (100 year site curve) for stated species (and source): white spruce—64 *(Farr 1967),* based on a sample of 30 trees in 6 plots
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—550 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2050 cubic feet/acre *(Farr 1967)*

General management considerations:
*Productivity of maturing stands may decline significantly as the permafrost and associated water table rise within the soil profile.
*Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*Logging roads may require ballast.
*The upper 14 to 33 inches (36 to 91 cm) of soil have low bearing capacity and are poor road building material.
*If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*Because cold soil temperatures restrict roots, trees are moderately subject to windthrow.

*Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*Trees suitable for planting are white spruce.

Suitable management practices:
*Use conventional equipment in harvesting, but limit its use when the soil is wet.
*Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

General management considerations:
*Excavation can expose soil material that is highly susceptible to wind erosion.
*Frost action limits construction of access roads, driveways, and buildings.
*This unit is a good source of roadfill.
*Septic tank absorption fields may function poorly because of the restricted permeability of the soil.
*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Consider the depth to which annual frosts penetrate in designing footings and road bases.
*Increase the size of the septic absorption area to compensate for the restricted permeability.
*Conduct on-site investigations to determine if massive ice features are present.
*Underlay roads with gravel to minimize frost action.

416—Tonsina silt loam, 2 to 7 percent slopes

Composition

Tonsina silt loam and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Tonsina Soil

Positions on landscape: drumlins and till plains
Slope range: 2 to 7 percent
Slope features: plane to convex
Organic mat on surface: 2 to 5 inches (5 to 13 cm) thick
Native vegetation: white spruce, aspen, tall willow, low shrubs, and herbs

Typical profile:
*0 to 15 inches (0 to 38 cm)—very dark grayish brown and dark brown silt loam
*15 to 60 inches (38 to 152 cm)—very dark grayish brown, dark gray, and gray sandy loam, fine sandy loam, and gravelly sandy loam

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: moderate
Depth to contrasting till material: 15 to 33 inches (38 to 91 cm)
Runoff: slow
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in similar positions and muskegs with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*soils in similar positions that have clayey, loamy, very gravelly, or sandy material at less than 10 inches (25 cm)
*soils that have slopes of less than 2 percent or more than 7 percent

Major Uses

Current uses: cropland, hayland and pastureland, homesteads, and wildlife habitat
Potential uses: forestland

Major Management Factors

Soil-related factors: wind erosion, water erosion, frost heaving, load supporting capacity, restricted permeability, and low fertility
Elevation: 1000 to 1500 feet (305 to 457 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*frost-free period—70 to 90 days (28 degree base temperature)

Cropland

General management considerations:
*Suitable crops for planting are climatically adapted

vegetables, short season grain varieties, potatoes, and hay.
*Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*Crops respond well to fertilizer if precipitation is adequate.
*Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.

Suitable management practices:
*Use conservation tillage and farm on the contour to conserve moisture.
*Rotate crops and use conservation tillage to maintain or improve soil fertility.
*Use shallow cuts when land smoothing to avoid exposing gravelly or cobbly till material.
*Cultivate and seed on the contour or across the slope and maintain crop residue on or near the surface to reduce the risk of water erosion.
*Grow row crops in rotation with hay and grain to reduce the hazard of water erosion.
*Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*Leave strips of trees as windbreaks when clearing.
*Conduct on-site investigations to determine if massive ice features are present.

Forestland

Principal tree species are: white spruce and quaking aspen
Common understory plants are: tall willow, soapberry, prickly rose, highbush cranberry, twinflower, pumpkinberry, and moss
Mean site index (100 year site curve) for stated species (and source): white spruce—64 *(Farr 1967),* based on a sample of 30 trees in 6 plots
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—550 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2050 cubic feet/acre *(Farr 1967)*

General management considerations:
*Productivity of maturing stands may decline significantly as the permafrost and associated water table rise within the soil profile.
*Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*Logging roads may require ballast.
*The upper 14 to 33 inches (36 to 91 cm) of soil have low bearing capacity and are poor road building material.
*If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*Because cold soil temperatures restrict roots, trees are moderately subject to windthrow.
*Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*Trees suitable for planting are white spruce.

Suitable management practices:
*Use conventional equipment in harvesting, but limit its use when the soil is wet.
*Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

General management considerations:
*Excavation can expose soil material that is highly susceptible to wind erosion.
*Excavation increases the risk of water erosion.
*Frost action limits construction of access roads, driveways, and buildings.
*Septic tank absorption fields may function poorly because of the restricted permeability of the soil.
*This unit is a good source of roadfill.
*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Consider the depth to which annual frosts penetrate in designing footings and road bases.
*Increase the size of the septic absorption area to compensate for the restricted permeability.
*Conduct on-site investigations to determine if massive ice features are present.
*Underlay roads with gravel to minimize frost action.

417—Tonsina silt loam, 7 to 12 percent slopes

Composition

Tonsina silt loam and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Tonsina Soil

Positions on landscape: drumlins and till plains
Slope range: 7 to 12 percent
Slope features: plane to convex
Organic mat on surface: 2 to 5 inches (5 to 13 cm) thick
Native vegetation: white spruce, aspen, tall willow, low shrubs, and herbs

Typical profile:
*****0 to 15 inches (0 to 38 cm)—very dark grayish brown and dark brown silt loam
*****15 to 60 inches (38 to 152 cm)—very dark grayish brown, dark gray, and gray sandy loam, fine sandy loam, and gravelly sandy loam

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: moderate
Depth to contrasting clayey material: 15 to 33 inches (38 to 91 cm)
Runoff: medium
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in similar positions and muskegs with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*****soils in similar positions that have loamy, very gravelly, or sandy material at less than 10 inches (25 cm)
*****soils that have slopes of less than 7 percent or more than 12 percent

Major Uses

Current uses: homesteads and wildlife habitat
Potential uses: hayland and pastureland and forestland

Major Management Factors

Soil-related factors: slope, wind erosion, water erosion, frost heaving, load supporting capacity, restricted permeability, and low fertility
Elevation: 1000 to 1500 feet (305 to 457 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—70 to 90 days (28 degree base temperature)

Hayland and Pastureland

General management considerations:
*****Land smoothing may expose gravelly or cobbly till material.
*****Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*****Hay crops respond well to fertilizer if precipitation is adequate.
*Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.

Suitable management practices:
*****Steep slopes limit suitable crops to permanent hay and pasture.
*****Use shallow cuts when land smoothing to avoid exposing gravelly or cobbly till material.
*****Use conservation tillage to conserve moisture.
*****Seed to permanent hay or pasture, cultivate or seed on the contour or across the slope, and leave native vegetation intact on steeper areas of the unit to reduce the risk of water erosion.
*****Maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*****Leave strips of trees as windbreaks when clearing.
*****Conduct on-site investigations to determine if massive ice features are present.

Forestland

Principal tree species are: white spruce and quaking aspen
Common understory plants are: tall willow, highbush cranberry, prickly rose, soapberry, twinflower, pumpkinberry, and moss
Mean site index (100 year site curve) for stated species (and source): white spruce—64 *(Farr 1967),* based on a sample of 30 trees in 6 plots
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—550 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2050 cubic feet/acre *(Farr 1967)*

General management considerations:
*****Productivity of maturing stands may decline significantly as the permafrost and associated

water table rise within the soil profile.
*Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*Logging roads may require ballast.
*Adequately designed drainage systems reduce the risk of concentrated flow erosion on roadways.
*The upper 14 to 33 inches (36 to 91 cm) of soil have low bearing capacity and are poor road building material.
*If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*Because cold soil temperatures restrict roots, trees are moderately subject to windthrow.
*Trees suitable for planting are white spruce.

Suitable management practices:
*Use conventional equipment in harvesting, but limit its use when the soil is wet.
*Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

General management considerations:
*Excavation can expose soil material that is highly susceptible to wind erosion.
*Excavation increases the risk of water erosion.
*Frost action limits construction of access roads, driveways, and buildings.
*This unit is a good source of roadfill.
*Septic tank absorption fields may function poorly because of restricted permeability of the soil.
*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.

Suitable management practices:
*Design and construct buildings and access roads to compensate for steepness of slope.
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Consider the depth to which annual frosts penetrate in designing footings and road bases.
*Install septic absorption lines in adjacent areas that are more nearly level.
*Increase the size of the septic absorption area to compensate for the restricted permeability.
*Conduct on-site investigations to determine if massive ice features are present.
*Underlay roads with gravel to minimize frost action.

418—Tonsina silt loam, 12 to 20 percent slopes

Composition

Tonsina silt loam and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Tonsina Soil

Positions on landscape: till plains and hills
Slope range: 12 to 20 percent
Slope features: convex
Organic mat on surface: 2 to 5 inches (5 to 13 cm) thick
Native vegetation: white spruce, aspen, tall willow, low shrubs, and herbs

Typical profile:
*0 to 15 inches (0 to 38 cm)—very dark grayish brown and dark brown silt loam
*15 to 60 inches (38 to 152 cm)—very dark grayish brown, dark gray, and gray sandy loam, fine sandy loam, and gravelly sandy loam

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: moderate
Depth to contrasting till material: 15 to 33 inches (38 to 91 cm)
Runoff: medium
Hazard of erosion: by water—slight if the organic mat is not removed, severe if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in similar positions and muskegs with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*soils in similar positions that have loamy, very gravelly, or sandy material at less than 10 inches (25 cm)
*soils that have slopes of less than 12 percent or more than 20 percent

Major Uses

Current uses: wildlife habitat
Potential uses: forestland

Major Management Factors

Soil-related factors: slope, wind erosion, water erosion, frost heaving, load supporting capacity, restricted permeability, and low fertility
Elevation: 1000 to 1400 feet (305 to 432 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—70 to 90 days (28 degree base temperature)

Forestland

Principal tree species are: white spruce, paper birch, and quaking aspen
Common understory plants are: tall willow, highbush cranberry, prickly rose, twinflower, pumpkinberry, and moss
Mean site index (100 year site curve) for stated species (and source): white spruce—64 *(Farr 1967),* based on a sample of 30 trees in 6 plots
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—550 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2050 cubic feet/acre *(Farr 1967)*

General management considerations:
*****Productivity of maturing stands may decline significantly as the permafrost and associated water table rise within the soil profile.
*****The main limitation for the harvesting of timber is slope.
*****Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*****Logging roads may require ballast.
*****Adequately designed drainage systems reduce the risk of concentrated flow erosion on roadways.
*****The upper 14 to 33 inches (36 to 91 cm) of soil have low bearing capacity and are poor road building material.
*****If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*****Because cold soil temperatures restrict roots, trees are moderately subject to windthrow.
*****Trees suitable for planting are white spruce.

Suitable management practices:
*****Use conventional equipment in harvesting, but limit its use when the soil is wet.
*****Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*****Thin trees before they reach commercial size and selectively cut mature trees to improve stands.

419—Copper River-Hanagita complex, 2 to 20 percent slopes

Composition

Copper River peat and similar inclusions: 65 percent
Hanagita silt loam and similar inclusions: 25 percent
Contrasting inclusions: 10 percent

Characteristics of Copper River Soil

Positions on landscape: hills
Microtopography: toe slopes and broad ridges
Slope range: 2 to 20 percent
Slope features: plane or convex
Organic mat on surface: 8 to 14 inches (20 to 36 cm) thick
Native vegetation: dwarf black and white spruce, tall alder, low and dwarf shrubs, and moss

Typical profile:
*****9 inches to 0 (23 cm to 0)—dark brown peat and black mucky peat consisting of fibrous and partially decomposed roots, moss, and twigs
*****0 to 3 inches (0 to 8 cm)—black, very dark brown, and dark brown silt loam
*****3 to 13 inches (8 to 33 cm)—perennially frozen black, dark brown, and very dark brown silt loam

Drainage class: very poorly drained
Permeability: in the organic mat—moderately rapid; in the mineral soil above the permafrost—moderate; in the permafrost—impermeable
Available water capacity: including organic mat—low
Root restricting feature: permafrost
Depth to permafrost: 0 to 10 inches (0 to 25 cm) below the surface of the mineral soil
Runoff: medium
Depth to perched water table: 0 to 10 inches (0 to 25 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Characteristics of Hanagita Soil

Positions on landscape: hills
Microtopography: ridgetops and shoulder slopes
Slope range: 10 to 20 percent
Slope features: convex

Organic mat on surface: 2 to 5 inches (5 to 13 cm) thick
Native vegetation: white spruce, aspen, tall willow, alder, low and dwarf shrubs, and moss

Typical profile:
*****0 to 7 inches (0 to 18 cm)—dark brown silt loam
*****7 to 15 inches (18 to 38 cm)—dark brown and dark yellowish brown silt loam
*****15 to 18 inches (38 to 46 cm)—brown gravelly silt loam
*****18 inches (46 cm)—consolidated bedrock

Drainage class: well drained
Permeability: above the bedrock—moderate
Available water capacity: low
Root restricting feature: bedrock
Depth to bedrock: 12 to 20 inches (30 to 52 cm)
Runoff: medium
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in similar positions that have sandy or very gravelly textures at less than 10 inches (25 cm)
*****soils in muskegs that have over 16 inches (40 cm) of organic material over mineral soil
*****soils that have slopes of more than 20 percent
*****rock outcroppings

Major Uses

Current uses: wildlife habitat
Potential uses: homesteads, hayland and pastureland, and forestland

Major Management Factors

Soil-related factors: available water capacity, depth to permafrost, depth to perched water table, frost heaving, low fertility, thermokarst, wind erosion, water erosion, rock outcroppings, slope, restricted permeability, and depth to bedrock
Elevation: 1200 to 2200 feet (365 to 670 m)
Climatic factors (average annual):
*****precipitation—14 inches (36 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—60 to 80 days (28 degree base temperature)

Hayland and Pastureland

Copper River soil with permafrost:
General management considerations:
*****Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost and subsequent lowering of the water table.
*****Differential subsidence may occur where massive ice features are present.

Suitable management practices:
*****Frozen substrata are variable and include silty, clayey, or loamy materials. Conduct on-site investigations before clearing.
*****Leave strips of trees as windbreaks when clearing.

Copper River soil when thawed:
General management considerations:
*****Due to frequent mid-summer frosts, a relatively short frost-free season, and steep slopes, suitable crops for planting are hay, permanent pasture, and grain crops harvested as hay.
*****Grasses grow well if they are adequately fertilized.
*****Additional drainage may be necessary in areas where natural drainage outlets are absent.
*****Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.
*****Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*****Occasional bedrock outcroppings and steep slopes may limit the size of continuous tillable units and also present a hazard to machinery.
*****Occasional surface boulders may present a hazard to machinery.
*****Hay crops respond well to fertilizer if precipitation is adequate.

Suitable management practices:
*****Use conservation tillage to conserve moisture and maintain or improve soil fertility.
*****Seed to permanent hay or pasture, cultivate or seed on the contour or across the slope, and leave native vegetation intact on steeper areas of the unit to reduce the risk of water erosion.
*Use shallow cuts when land smoothing to avoid exposing gravelly, sandy, clayey, or loamy substratum materials.
*****Maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*****Conduct on-site investigations to determine if massive ice features are present.

Hanagita soil:
General management considerations:
*The shallow depth to bedrock severely limits the use of this soil for hayland and pastureland.

Forestland

Copper River soil with permafrost:
Principal tree species are: white spruce and black spruce
Common understory plants are: Labrador tea ledum, alder, lowbush cranberry, prickly rose, pumpkinberry, and moss
Mean site index and yields: not estimated—the presence of permafrost and the associated perched water table result in stunted growth and low site productivity

General management considerations:
*Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost, lowering of the water table, and increased site productivity.

Copper River soil when thawed:
Principal tree species are: white spruce and paper birch
Common understory plants are: tall willow, alder, Labrador tea ledum, prickly rose, lowbush cranberry, black crowberry, highbush cranberry, and pumpkinberry
Estimated site index (100 year site curve) for stated species: white spruce—64
Estimated total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—550 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2050 cubic feet/acre *(Farr 1967)*

General management considerations:
*Productivity of maturing stands may decline significantly as the permafrost and associated water table rise within the soil profile.
*Adequately designed drainage systems reduce the risk of concentrated flow erosion.
*The main limitation for the harvesting of timber is slope.
*Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*Logging roads may require ballast.
*The upper 14 to 33 inches (36 to 91 cm) of the soil have low bearing capacity and are poor roadbuilding material.
*If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*Because cold temperatures restrict roots, trees are subject to windthrow.
*Tree seedlings have a moderate rate of survival because of cold soil temperatures.
*Trees suitable for planting are white spruce and paper birch.

Suitable management practices:
*Use conventional equipment in harvesting, but limit its use when the soil is wet.
*Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Hanagita soil:
Principal tree species are: white spruce and paper birch
Common understory plants are: tall willow, alder, prickly rose, soapberry, lowbush cranberry, pumpkinberry, and moss
Site index and yields: not estimated

General management considerations:
*The main limitation for the harvesting of timber is slope.
*Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*Adequately designed drainage systems reduce the risk of concentrated flow erosion on roadways.
*The upper 12 to 20 inches (30 to 50 cm) of soil have low bearing capacity and are poor road building material.
*Because roots are restricted by shallow bedrock, trees are subject to windthrow.
*If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*Because cold soil temperatures restrict roots, trees are moderately subject to windthrow.
*Tree seedlings have a moderate rate of survival because of root restriction by unweathered bedrock.
*Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*Trees suitable for planting are white spruce and paper birch.

Suitable management practices:
*Use conventional equipment in harvesting, but limit its use when the soil is wet.
*Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

Copper River soil with permafrost:
General management considerations:
*****Excavation is hampered by permafrost.
*****Excavation can expose material that is highly susceptible to wind erosion.
*****Excavation increases the risk of water erosion.
*****Frost action limits construction of access roads, driveways, and buildings.
*****Local roads may require a special base to prevent permafrost damage.
*****Road cutbanks are subject to slumping.
*****The quality of roadbeds and road surfaces is adversely affected by frost action and limited soil strength.
*****Areas of large-scale development may require thorough clearing and supplemental drainage to overcome permafrost limitations.
*****Septic tank absorption fields may function poorly because of wetness and the limited depth to permafrost, which restrict the movement and infiltration of effluent.

Suitable management practices:
*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*****Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.
*****Construct buildings on thick gravel pads to reduce subsidence caused by the melting of permafrost.
*****Leave the vegetation and organic mat intact where it is desirable to maintain the present level of permafrost.
*****Underlay roads with gravel to minimize frost action.
*****Clearing large areas with obvious surface drainage outlets results in the eventual subsidence of the permafrost and water table to below 60 inches (152 cm).
*****Establish gently sloping grades on cutbanks and revegetate as soon as possible to reduce the risk of slumping.

Copper River soil when thawed:
General management considerations:
*****Excavation increases the risk of water erosion.
*****Excavation can expose material that is highly susceptible to wind erosion.
*****Frost action limits construction of access roads, driveways, and buildings.
*****Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.
*****Septic tank absorption fields may function poorly because of the restricted permeability of the soil.
*****Road cutbanks are subject to slumping.

Suitable management practices:
*****Design and construct buildings and access roads to compensate for steepness of slope.
*****Establish gently sloping grades on cutbanks and revegetate as soon as possible to reduce the risk of slumping.
*****Consider the depth to which annual frosts penetrate when designing footings and road bases.
*****Install septic absorption lines in adjacent areas that are more nearly level.
*****Increase the size of the septic absorption area to compensate for the restricted permeability.
*****Conduct on-site investigations to determine if massive ice features are present.
*****Underlay roads with gravel to minimize frost action.

Hanagita soil:
General management considerations:
*****Shallow depth to bedrock and slope severely restrict the use of this soil for building site development.

420—Tonsina-Hanagita complex, 2 to 20 percent slopes

Composition

Tonsina silt loam and similar inclusions: 65 percent
Hanagita silt loam and similar inclusions: 25 percent
Contrasting inclusions: 10 percent

Characteristics of Tonsina Soil

Positions on landscape: hills
Microtopography: toeslopes and broad ridgetops
Slope range: 2 to 20 percent
Slope features: plane or convex
Organic mat on surface: 1 to 5 inches (2 to 13 cm) thick
Native vegetation: white spruce, aspen, tall willow, low shrubs, and herbs

Typical profile:
*****0 to 17 inches (0 to 43 cm)—very dark brown and dark brown silt loam
*****17 to 30 inches (43 to 76 cm)—dark gray gravelly sandy loam
*****30 to 60 inches (76 to 152cm)—dark gray cobbly sandy loam
Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: moderate

Depth to contrasting till material: 15 to 33 inches (38 to 91 cm)
Runoff: slow to medium
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Characteristics of Hanagita Soil

Positions on landscape: hills
Microtopography: ridgetops and shoulder slopes
Slope range: 10 to 20 percent
Slope features: convex
Organic mat on surface: 2 to 5 inches (5 to 13 cm) thick
Native vegetation: white spruce, tall willow, alder, low and dwarf shrubs, and moss

Typical profile:
*****0 to 7 inches (0 to 18 cm)—dark brown silt loam
*****7 to 15 inches (18 to 38 cm)—dark brown and dark yellowish brown silt loam
*****15 to 18 inches (38 to 46 cm)—brown gravelly silt loam
*****18 inches (46 cm)—consolidated bedrock

Drainage class: well drained
Permeability: above the bedrock—moderate
Available water capacity: low
Root restricting feature: bedrock
Depth to bedrock: 12 to 20 inches (30 to 52 cm)
Runoff: medium
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in similar positions that have sandy or very gravelly textures at less than 10 inches (25 cm)
*****soils in muskegs that have over 16 inches (40 cm) of organic material over mineral soil
*****soils that have slopes of more than 20 percent
*****rock outcroppings

Major Uses

Current uses: wildlife habitat
Potential uses: homesteads, hayland and pastureland, and forestland

Major Management Factors

Soil-related factors: available water capacity, frost heaving, low fertility, wind erosion, water erosion, rock outcroppings, slope, restricted permeability, and depth to bedrock
Elevation: 1200 to 2200 feet (365 to 670 m)
Climatic factors (average annual):
*****precipitation—14 inches (36 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—60 to 80 days (28 degree base temperature)

Hayland and Pastureland

Tonsina soil:
General management considerations:
*****Due to frequent mid-summer frosts, a relatively short frost-free season, and steep slopes, suitable crops for planting are hay, permanent pasture, and grain crops harvested as hay.
*****Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.
*****Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*****Occasional bedrock outcroppings and steep slopes may limit the size of continuous tillable units and also present a hazard to machinery.
*****Occasional surface boulders may present a hazard to machinery.
*****Hay crops respond well to fertilizer if precipitation is adequate.

Suitable management practices:
*****Use conservation tillage to conserve moisture and maintain or improve soil fertility.
*****Seed to permanent hay or pasture, cultivate and seed on the contour or across the slope, and leave native vegetation intact on steeper areas of this unit to reduce the risk of water erosion.
*****Use shallow cuts when land smoothing to avoid exposing gravelly or cobbly till material.
*****Maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.

Hanagita soil:
General management considerations:
*****The shallow depth to bedrock severely limits the use of this soil for hayland and pastureland.

Forestland

Tonsina soil:

Principal tree species are: white spruce and paper birch

Common understory plants are: tall willow, alder, Labrador tea ledum, prickly rose, lowbush cranberry, black crowberry, highbush cranberry, and pumpkinberry

Estimated site index (100 year site curve) for stated species: white spruce—64

Estimated total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—550 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2050 cubic feet/acre *(Farr 1967)*

General management considerations:

*****Productivity of maturing stands may decline significantly as the permafrost and associated water table rise within the soil profile.

*****The main limitation for the harvesting of timber is slope.

*****Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.

*****Logging roads may require ballast.

*****The upper 14 to 33 inches (36 to 91 cm) of the soil have low bearing capacity and are poor roadbuilding material.

*****If seed trees are in the stand, reforestation occurs naturally in cutover areas.

*****Because cold temperatures restrict roots, trees are subject to windthrow.

*****Trees suitable for planting are white spruce and paper birch.

Suitable management practices:

*****Use conventional equipment in harvesting, but limit its use when the soil is wet.

*****Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.

*****Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Hanagita soil:

Principal tree species are: white spruce and paper birch

Common understory plants are: tall willow, alder, prickly rose, soapberry, lowbush cranberry, pumpkinberry, and moss

Site index and yields: not estimated

General management considerations:

*****The main limitation for the harvesting of timber is slope.

*****Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.

*****Adequately designed drainage systems reduce the risk of concentrated flow erosion on roadways.

*****The upper 12 to 20 inches (30 to 50 cm) of soil have low bearing capacity and are poor road building material.

*****Because roots are restricted by shallow bedrock, trees are subject to windthrow.

*****If seed trees are in the stand, reforestation occurs naturally in cutover areas.

*****Because cold soil temperatures restrict roots, trees are moderately subject to windthrow.

*****Tree seedlings have a moderate rate of survival because of root restriction by unweathered bedrock.

*****Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.

*****Trees suitable for planting are white spruce and paper birch.

Suitable management practices:

*****Use conventional equipment in harvesting, but limit its use when the soil is wet.

*****Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.

*****Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

Tonsina soil:

General management considerations:

*****Excavation increases the risk of water erosion.

*****Excavation can expose material that is highly susceptible to wind erosion.

*****Frost action limits construction of access roads, driveways, and buildings.

*****Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.

*****Septic tank absorption fields may function poorly because of the restricted permeability of the soil.

*****Road cutbanks are subject to slumping.

Suitable management practices:

*****Design and construct buildings and access roads to compensate for steepness of slope.

*****Establish gently sloping grades on cutbanks and revegetate as soon as possible to reduce the risk of slumping.

*****Consider the depth to which annual frosts penetrate when designing footings and road bases.

*****Install septic absorption lines in adjacent areas that are more nearly level.

*Increase the size of the septic absorption area to compensate for the restricted permeability.
*Conduct on-site investigations to determine if massive ice features are present.
*Underlay roads with gravel to minimize frost action.

Hanagita soil:
General management considerations:
*Shallow depth to bedrock and slope severely restrict the use of this soil for building site development.

421—Cryochrepts-Rock outcrop complex, 30 to 70 percent slopes

Composition

Cryochrepts and similar inclusions: 65 percent
Rock outcrop: 25 percent
Contrasting inclusions: 10 percent

Characteristics of Cryochrept Soils

Positions on landscape: mountainsides and escarpments
Microtopography: footslopes and toeslopes
Slope range: 30 to 70 percent
Slope features: convex
Organic mat on surface: 1 to 6 inches (2 to 15 cm) thick
Native vegetation: spruce, quaking aspen, low shrubs, herbs, and moss

Sample profile:
*0 to 12 inches (0 to 30 cm)—very dark brown very channery silt loam
*12 to 60 inches (30 to 152 cm)—dark gray very channery sandy loam

Depth class: shallow to very deep (10 to over 60 inches, or 25 to over 152 cm) to bedrock or permafrost
Drainage class: well drained
Permeability: moderately slow to moderately rapid
Available water capacity: low to high
Runoff: rapid
Hazard of erosion: by water—severe if the organic mat is not removed, severe if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Characteristics of Rock Outcrop

Positions on landscape: mountain and hill slopes
Microtopography: ridgetops, shoulder slopes, and escarpments
Slope range: 50 to 70 percent

Included Areas

*soils that have slopes of less than 30 percent

Major Uses

Current uses: wildlife habitat

Major Management Factors

Elevation: 900 to 2200 feet (274 to 670 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*frost-free period—60 to 90 days (28 degree base temperature)

422—Cryofibrists-Cryohemists complex, 0 to 2 percent slopes

Composition

Cryofibrists and similar inclusions: 50 percent
Cryohemists and similar inclusions: 40 percent
Contrasting inclusions: 10 percent

Characteristics of Cryofibrist Soils

Positions on landscape: muskegs
Microtopography: depressions along the perimeter of lakes and ponds
Slope range: 0 to 1 percent
Slope features: plane or concave
Organic mat on surface: 16 to over 60 inches (40 to over 152 cm) thick
Native vegetation: sedges and occasional grasses

Sample profile:
*0 to 11 inches (0 to 28 cm)—dark reddish brown peat consisting of slightly decomposed sedge, twig, and root fibers
*11 to 60 inches (28 to 152 cm)—very dark brown slightly decomposed sedge, twig, and root fibers

Depth to mineral soil: 16 to over 60 inches (40 to over 152 cm)
Depth to water table: 10 inches (25 cm) above the surface of the organic mat to 10 inches (25 cm) below the surface
Drainage class: very poorly drained
Runoff: ponded to very slow
Hazard of erosion: by water—slight; by wind—slight

Hazard of flooding: none

Characteristics of Cryohemist Soils

Positions on landscape: muskegs
Slope range: 0 to 2 percent
Slope features: plane or concave
Organic mat on surface: 18 to over 60 inches (46 to over 152 cm) thick
Native vegetation: low ericaceous shrubs and willows, sedges, moss, and stunted spruce

Sample profile:
*0 to 5 inches (0 to 13 cm)—very dusky red mucky peat consisting of slightly decomposed organic material
*5 to 60 inches (13 to 152 cm)—very dark brown partially decomposed organic material

Depth to mineral soil: 18 to over 60 inches (46 to over 152 cm)
Depth to permafrost: 16 to over 60 inches (40 to over 152 cm)
Depth to water table: 0 to 10 inches (0 to 25 cm) below the surface of the organic mat
Drainage class: very poorly drained
Runoff: very slow
Hazard of erosion: by water—slight; by wind—slight
Hazard of flooding: none

Included Areas

*****water
*****soils that have slopes of more than 2 percent
*****soils in convex positions that lack thick organic mats and water tables within 40 inches (100 cm) of the mineral soil surface

Major Uses

Current uses: wildlife habitat

Major Management Factors

Elevation: 900 to 2100 feet (274 to 640 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—60 to 90 days (28 degree base temperature)

423—Cryohemists, 0 to 2 percent slopes

Composition

Cryohemists and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Characteristics of Cryohemist Soils

Positions on landscape: muskegs
Slope range: 0 to 2 percent
Slope features: plane or concave
Organic mat on surface: 16 to over 60 inches (40 to over 152 cm) thick
Native vegetation: low ericaceous shrubs and willows, sedges, moss, and stunted spruce

Sample profile:
*0 to 22 inches (0 to 56 cm)—very dusky red and dark reddish brown mucky peat consisting of slightly decomposed root, sedge, and ericaceous shrub fibers
*22 to 29 inches (56 to 73 cm)—perennially frozen, dark grayish brown clay loam

Depth to mineral soil: 16 to over 60 inches (40 to over 152 cm)
Depth to permafrost: 16 to over 60 inches (40 to over 152 cm)
Depth to water table: 0 to 10 inches (0 to 25 cm) below the surface of the organic mat
Drainage class: very poorly drained
Permeability: above the mineral soil or permafrost—moderately rapid; below this—impermeable if permafrost, or very slow to moderately rapid in mineral soils.
Runoff: very slow
Hazard of erosion: by water—slight; by wind—slight
Hazard of flooding: none

Included Areas

*****soils that have slopes of more than 2 percent
*****soils in convex positions that lack thick organic mats and water tables within 40 inches (100 cm) of the mineral soil surface

Major Uses

Current uses: wildlife habitat

Major Management Factors

Elevation: 900 to 2100 feet (274 to 640 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—60 to 90 days (28 degree base temperature)

424—Cryorthents and Cryochrepts, 30 to 70 percent slopes

Composition

Cryorthents, Cryochrepts and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Characteristics of Cryorthent Soils

Positions on landscape: escarpments
Microtopography: southerly exposures
Slope range: 30 to 70 percent
Slope features: plane or convex
Organic mat on surface: 0 to 1 inch (0 to 2 cm) thick
Native vegetation: scattered grasses and forbs, low shrubs, quaking aspen, and white spruce

Sample profile:
*****0 to 7 inches (0 to 18 cm)—dark gray loam
*****7 to 34 inches (18 to 86 cm)—dark gray clay loam
*****34 to 60 inches (86 to 152 cm)—dark gray silty clay loam

Depth class: very deep (more than 60 inches, or more than 152 cm)
Drainage class: well drained to excessively drained
Permeability: moderately slow to rapid
Available water capacity: low to high
Runoff: rapid
Hazard of erosion: by water—severe if the organic mat is not removed, severe if the organic mat is removed; by wind—severe if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Characteristics of Cryochrept Soils

Positions on landscape: escarpments
Microtopography: northerly exposures
Slope range: 30 to 70 percent
Slope features: plane or convex
Organic mat on surface: 2 to 10 inches (5 to 25 cm) thick
Native vegetation: black and white spruce, low and dwarf shrubs, herbs, and moss

Sample profile:
*****0 to 3 inches (0 to 8 cm)—dark brown and dark yellowish brown silt loam
*****3 to 60 inches (8 to 152 cm)—dark grayish brown and olive gray silty clay and silty clay loam

Depth class: shallow to very deep (10 to over 60 inches, or 25 to over 152 cm) to permafrost
Drainage class: well drained to excessively drained
Permeability: moderately slow to moderately rapid
Available water capacity: low to high
Runoff: medium to rapid
Hazard of erosion: by water—moderate if the organic mat is not removed, severe if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils that have slopes of less than 30 percent

Major Uses

Current uses: wildlife habitat

Major Management Factors

Elevation: 600 to 2000 feet (183 to 610 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—60 to 90 days (28 degree base temperature)

425—Dadina peat, 0 to 2 percent slopes

Composition

Dadina peat and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Characteristics of Dadina Soil

Positions on landscape: broad lacustrine terraces and till plains
Microtopography: localized outwash deposits
Slope range: 0 to 2 percent
Slope features: plane or concave
Organic mat on surface: 8 to 12 inches (20 to 30 cm) thick

Native vegetation: black and white spruce, tall willow, low and dwarf shrubs, herbs, and moss

Typical profile:
*****10 inches to 0 (25 cm to 0)—dark brown peat consisting of fibrous and partially decomposed roots, moss, and twigs
*****0 to 3 inches (0 to 8 cm)— very dark brown mucky silt loam
*****3 to 22 inches (8 to 56 cm)—dark yellowish brown, dark brown, and dark grayish brown very gravelly sand
*****22 to 32 inches (56 to 81 cm)—perennially frozen, dark grayish brown very gravelly sand

Drainage class: very poorly drained or poorly drained
Permeability: in the organic mat—moderately rapid; in the silty loess mantle—moderate; in the gravelly material—very rapid; in the permafrost—impermeable
Available water capacity: including organic mat—low
Root restricting feature: permafrost
Depth to permafrost: 18 to 35 inches (46 to 89 cm) below the surface of the mineral soil
Depth to contrasting gravelly material: 1 to 5 inches (2 to 13 cm)
Runoff: very slow
Depth to perched water table: 8 to 20 inches (20 to 50 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in similar positions that lack thick organic mats, permafrost, and the associated perched water table within 40 inches (100 cm)
*****soils in muskegs that have over 16 inches (40 cm) of organic material overlying mineral soil
*****soils in similar positions with dominantly loamy or clayey textures within 40 inches (100 cm) of the mineral surface
*****soils with slopes greater than 2 percent

Major Uses

Current uses: wildlife habitat
Potential uses: homesteads and gravel source

Major Management Factors

Soil-related factors: depth to permafrost, wind erosion, depth to perched water table, frost heaving, thermokarst, and restricted permeability
Elevation: 1400 to 2300 feet (427 to 701 m)

Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—60 to 80 days (28 degree base temperature)

Building Site Development

With permafrost:
General management considerations:
*****Excavation is hampered by permafrost.
*****Excavation can expose material that is highly susceptible to wind erosion.
*****Cutbanks are not stable and are subject to caving.
*****Differential subsidence may occur where massive ice features are present.
*****Areas of large-scale development may require thorough clearing of large areas and supplemental drainage to overcome the permafrost limitations.
*****Frost action limits construction of access roads, driveways, and buildings.
*****Local roads may require a special base to prevent permafrost damage.
*****Septic tank absorption fields can be expected to function poorly because of wetness and the limited depth to permafrost, which restrict the movement and infiltration of effluent.

Suitable management practices:
*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*****Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.
*****Construct buildings on thick gravel pads to reduce subsidence caused by the melting of permafrost.
*****Leave the vegetation and organic mat intact where it is desirable to maintain the present level of permafrost.
*****Underlay roads with gravel to minimize frost action.
*****Clearing large areas with obvious surface drainage outlets results in the eventual subsidence of the permafrost and water table to below 60 inches (152 cm).

When thawed:
General management considerations:
*****Depressional areas that comprise up to 10 percent of this unit remain wet after clearing.
*****Excavation can expose material that is highly susceptible to wind erosion.
*****Differential subsidence may occur in areas where

massive ice features are present and may continue for several years following excavation.
*Cutbanks are not stable and are subject to caving.
*Septic tank absorption fields may function poorly in many areas because of wetness.
*This unit is a good source of gravel.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Establish gently sloping grades on cutbanks and excavations to reduce the risk of caving.
*Provide drainage to reduce wetness if roads and buildings are to be constructed in depressional areas.
*Conduct on-site investigations to determine if massive ice features are present.

426—Dadina-Klanelneechena complex, 0 to 2 percent slopes

Composition

Dadina peat and similar inclusions: 45 percent
Klanelneechena peat and similar inclusions: 45 percent
Contrasting inclusions: 10 percent

Characteristics of Dadina Soil

Positions on landscape: broad lacustrine terraces and till plains
Microtopography: localized outwash deposits
Slope range: 0 to 2 percent
Slope features: plane
Organic mat on surface: 8 to 12 inches (20 to 30 cm) thick
Native vegetation: black and white spruce, tall willow, low and dwarf shrubs, herbs and moss

Typical profile:
*10 inches to 0 (25 cm to 0)—dark brown peat consisting of fibrous and partially decomposed roots, moss, and twigs
*0 to 1 inch (0 to 2 cm)— very dark brown mucky silt loam
*1 to 30 inches (2 to 76 cm)—dark grayish brown very gravelly sand
*30 to 40 inches (76 to 102 cm)—perennially frozen, dark grayish brown very gravelly sand

Drainage class: very poorly drained or poorly drained
Permeability: in the organic mat—moderately rapid; in the silty loess mantle—moderate; in the gravelly material—very rapid; in the permafrost—impermeable
Available water capacity: including organic mat—low
Root restricting feature: permafrost
Depth to permafrost: 18 to 35 inches (46 to 89 cm) below the surface of the mineral soil
Depth to contrasting gravelly material: 1 to 5 inches (2 to 13 cm)
Runoff: very slow
Depth to perched water table: 8 to 20 inches (20 to 50 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Characteristics of Klanelneechena Soil

Positions on landscape: broad lacustrine terraces and till plains
Microtopography: localized outwash deposits
Slope range: 0 to 2 percent
Slope features: plane or concave
Organic mat on surface: 8 to 13 inches (20 to 35 cm) thick
Native vegetation: dwarf black and white spruce, low and dwarf shrubs, herbs, and moss

Typical profile:
*12 inches to 0 (30 cm to 0)—black peat and dark reddish brown mucky peat consisting of fibrous and partially decomposed roots, moss, and twigs
*0 to 1 inch (0 to 2 cm)— very dark brown mucky silt loam
*1 to 15 inches (2 to 38 cm)—very dark gray coarse sand
*15 to 25 inches (38 to 63 cm)—perennially frozen, very dark gray coarse sand

Drainage class: very poorly drained or poorly drained
Permeability: in the organic mat—moderately rapid; in the mineral soil—moderate over rapid; in the permafrost—impermeable
Available water capacity: including organic mat—low
Root restricting feature: permafrost
Depth to permafrost: 15 to 34 inches (38 to 86 cm) below the surface of the mineral soil
Depth to contrasting sandy material: 1 to 3 inches (2 to 8 cm)
Runoff: very slow
Depth to perched water table: 7 to 15 inches (18 to 38 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed;

by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in similar positions that lack thick organic mats, permafrost, and the associated perched water table within 40 inches (100 cm)
*soils in muskegs that have over 16 inches (40 cm) of organic material overlying mineral soil and permafrost
*soils in similar positions with dominantly loamy or clayey textures within 40 inches (100 cm) of the mineral surface
*soils with slopes greater than 2 percent

Major Uses

Current uses: wildlife habitat
Potential uses: homesteads and gravel source

Major Management Factors

Soil-related factors: depth to permafrost, wind erosion, depth to perched water table, thermokarst, and restricted permeability
Elevation: 1400 to 2300 feet (427 to 701 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*frost-free period—60 to 80 days (28 degree base temperature)

Building Site Development

Dadina soil with permafrost:
General management considerations:
*Excavation is hampered by permafrost.
*Excavation can expose material that is highly susceptible to wind erosion.
*Cutbanks are not stable and are subject to caving.
*Differential subsidence may occur where massive ice features are present.
*Areas of large-scale development may require thorough clearing of large areas and supplemental drainage to overcome the permafrost limitations.
*Frost action limits construction of access roads, driveways, and buildings.
*Local roads may require a special base to prevent permafrost damage.
*Septic tank absorption fields can be expected to function poorly because of wetness and the limited depth to permafrost, which restrict the movement and infiltration of effluent.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.
*Construct buildings on thick gravel pads to reduce subsidence caused by the melting of permafrost.
*Leave the vegetation and organic mat intact where it is desirable to maintain the present level of permafrost.
*Underlay roads with gravel to minimize frost action.
*Clearing large areas with obvious surface drainage outlets results in the eventual subsidence of the permafrost and water table to below 60 inches (152 cm).

Dadina soil when thawed:
General management considerations:
*Depressional areas that comprise up to 10 percent of this unit remain wet after clearing.
*Excavation can expose material that is highly susceptible to wind erosion.
*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.
*Cutbanks are not stable and are subject to caving.
*Septic tank absorption fields may function poorly in many areas because of wetness.
*This unit is a good source of gravel.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Establish gently sloping grades on cutbanks and excavations to reduce the risk of caving.
*Provide drainage to reduce wetness if roads and buildings are to be constructed in depressional areas.
*Conduct on-site investigations to determine if massive ice features are present.

Klanelneechena soil with permafrost:
General management considerations:
*Excavation is hampered by permafrost.
*Excavation can expose material that is highly susceptible to wind erosion.
*Cutbanks are not stable and are subject to caving.
*Differential subsidence may occur where massive ice features are present.
*Areas of large-scale development may require thorough clearing of large areas and supplemental drainage to overcome the permafrost limitations.

*Frost action limits construction of access roads, driveways, and buildings.
*Local roads may require a special base to prevent permafrost damage.
*Septic tank absorption fields can be expected to function poorly because of wetness and the limited depth to permafrost, which restrict the movement and infiltration of effluent.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.
*Construct buildings on thick gravel pads to reduce subsidence caused by the melting of permafrost.
*Leave the vegetation and organic mat intact where it is desirable to maintain the present level of permafrost.
*Underlay roads with gravel to minimize frost action.
*Clearing large areas with obvious surface drainage outlets results in the eventual subsidence of the permafrost and water table to below 60 inches (152 cm).

Klanelneechena soil when thawed:
General management considerations:
*Depressional areas that comprise up to 10 percent of this unit remain wet after clearing.
*Excavation can expose material that is highly susceptible to wind erosion.
*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.
*Cutbanks are not stable and are subject to caving.
*Septic tank absorption fields may function poorly in many areas because of wetness.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Establish gently sloping grades on cutbanks and excavations to reduce the risk of caving.
*Provide drainage to reduce wetness if roads and buildings are to be constructed in depressional areas.
*Conduct on-site investigations to determine if massive ice features are present.

427—Dadina-Tolsona complex, 0 to 5 percent slopes

Composition

Dadina peat and similar inclusions: 45 percent
Tolsona peat and similar inclusions: 45 percent
Contrasting inclusions: 10 percent

Characteristics of Dadina Soil

Positions on landscape: till plains
Microtopography: localized outwash deposits
Slope range: 0 to 2 percent
Slope features: plane
Organic mat on surface: 8 to 12 inches (20 to 30 cm) thick
Native vegetation: black and white spruce, tall willow, low and dwarf shrubs, herbs, and moss

Typical profile:
*10 inches to 0 (25 cm to 0)—dark brown peat consisting of fibrous and partially decomposed roots, moss, and twigs
*0 to 1 inch (0 to 2 cm)— very dark brown mucky silt loam
*1 to 27 inches (2 to 69 cm)—dark grayish brown very gravelly sand
*27 to 37 inches (69 to 94 cm)—perennially frozen, dark grayish brown very gravelly sand

Drainage class: very poorly drained or poorly drained
Permeability: in the organic mat—moderately rapid; in the silty loess mantle—moderate; in the gravelly material—very rapid; in the permafrost—impermeable
Available water capacity: including organic mat—low
Root restricting feature: permafrost
Depth to permafrost: 18 to 35 inches (46 to 89 cm) below the surface of the mineral soil
Depth to contrasting gravelly material: 1 to 3 inches (2 to 8 cm)
Runoff: very slow
Depth to perched water table: 8 to 20 inches (20 to 50 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Characteristics of Tolsona Soil

Positions on landscape: till plains
Microtopography: localized outwash deposits
Slope range: 0 to 5 percent

Slope features: plane or concave
Organic mat on surface: 8 to 13 inches (20 to 33 cm) thick
Native vegetation: black and white spruce, low and dwarf shrubs, herbs, and moss

Typical profile:
*8 inches to 0 (20 cm to 0)—black peat and mucky peat consisting of fibrous and partially decomposed roots, moss, and twigs
*0 to 1 inch (0 to 2 cm)—black and very dark brown mucky silt loam
*1 to 19 inches (2 to 48 cm)—dark grayish brown loam
*19 to 29 inches (48 to 74 cm)—perennially frozen, dark grayish brown loam

Drainage class: very poorly drained or poorly drained
Permeability: in the organic mat—moderately rapid; in the mineral soil—moderate; in the permafrost—impermeable
Available water capacity: including organic mat—low
Root restricting feature: permafrost
Depth to permafrost: 14 to 26 inches (36 to 66 cm) below the surface of the mineral soil
Depth to contrasting loamy till material: 1 to 8 inches (2 to 20 cm)
Runoff: slow
Depth to perched water table: 12 to 24 inches (30 to 61 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in similar positions that lack thick organic mats, permafrost, and the associated perched water table within 40 inches (100 cm)
*soils in muskegs that have over 16 inches (40 cm) of organic material overlying mineral soil and permafrost
*soils in similar positions with dominantly clayey textures within 40 inches (100 cm) of the mineral surface
*soils with slopes greater than 5 percent

Major Uses

Current uses: wildlife habitat
Potential uses: homesteads, gravel source, and roadfill source

Major Management Factors

Soil-related factors: wind erosion, depth to permafrost, frost heaving, load supporting capacity, restricted permeability, thermokarst, and depth to perched water table
Elevation: 1400 to 2300 feet (427 to 701 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*frost-free period—60 to 80 days (28 degree base temperature)

Building Site Development

Dadina soil with permafrost:
General management considerations:
*Excavation is hampered by permafrost.
*Excavation can expose material that is highly susceptible to wind erosion.
*Cutbanks are not stable and are subject to caving.
*Differential subsidence may occur where massive ice features are present.
*Areas of large-scale development may require thorough clearing of large areas and supplemental drainage to overcome the permafrost limitations.
*Frost action limits construction of access roads, driveways, and buildings.
*Local roads may require a special base to prevent permafrost damage.
*Septic tank absorption fields may function poorly because of wetness and the limited depth to permafrost, which restrict the movement and infiltration of effluent.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.
*Construct buildings on thick gravel pads to reduce subsidence caused by the melting of permafrost.
*Leave the vegetation and organic mat intact where it is desirable to maintain the present level of permafrost.
*Establish gently sloping grades on cutbanks and excavations to reduce the risk of caving.
*Underlay roads with gravel to minimize frost action.
*Clearing large areas with obvious surface drainage outlets results in the eventual subsidence of the permafrost and water table to below 60 inches (152 cm).

Dadina soil when thawed:

General management considerations:

*****Depressional areas that comprise up to 10 percent of this unit remain wet after clearing.
*****Excavation can expose material that is highly susceptible to wind erosion.
*****Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.
*****Cutbanks are not stable and are subject to caving.
*****Septic tank absorption fields may function poorly in many areas because of wetness.
*****This unit is a good source of gravel.

Suitable management practices:

*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*****Stockpile topsoil and use it to reclaim areas disturbed during construction.
*****Establish gently sloping grades on cutbanks and excavations to reduce the risk of caving.
*****Provide drainage to reduce wetness if roads and buildings are to be constructed in depressional areas.
*****Conduct on-site investigations to determine if massive ice features are present.

Tolsona soil with permafrost:

General management considerations:

*****Excavation is hampered by permafrost.
*****Excavation can expose material that is highly susceptible to wind erosion.
*****Differential subsidence may occur where massive ice features are present.
*****Areas of large-scale development may require thorough clearing of large areas and supplemental drainage to overcome the permafrost limitations.
*****Frost action limits construction of access roads, driveways, and buildings.
*****Local roads may require a special base to prevent permafrost damage.
*****Septic tank absorption fields may function poorly because of wetness and the limited depth to permafrost, which restrict the movement and infiltration of effluent.

Suitable management practices:

*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*****Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.
*****Construct buildings on thick gravel pads to reduce subsidence caused by the melting of permafrost.
*****Leave the vegetation and organic mat intact where it is desirable to maintain the present level of permafrost.
*****Underlay roads with gravel to minimize frost action.
*****Clearing large areas with obvious surface drainage outlets results in the eventual subsidence of the permafrost and water table to below 60 inches (152 cm).

Tolsona soil when thawed:

General management considerations:

*****Depressional areas that comprise up to 10 percent of this unit remain wet after clearing.
*****Excavation can expose material that is highly susceptible to wind erosion.
*****Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.
*****Frost action limits the construction of access roads, driveways, and buildings.
*****Septic tank absorption fields may function poorly in many areas because of wetness.

Suitable management practices:

*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*****Provide drainage to reduce wetness if roads and buildings are to be constructed in depressional areas.
*****Consider the depth to which annual frosts penetrate when designing footings and road bases.
*****Increase the size of septic absorption areas to compensate for the restricted permeability.
*****Underlay roads with gravel to minimize frost action.
*****Conduct on-site investigations to determine if massive ice features are present.

428—Pits, gravel

Composition

Pits, gravel: 100 percent

Characteristics of Pits, Gravel

Positions on landscape: till plains, stream terraces, moraines, and drumlins
Slope range: 0 to 20 percent
Slope features: plane to convex
Native vegetation: sparse scattered low shrubs
Material: active or abandoned gravel mining locations having loamy and sandy deposits with a high content of gravel and cobble

429—Gulkana silt loam, 0 to 2 percent slopes

Composition

Gulkana silt loam and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Gulkana Soil

Positions on landscape: stream terraces
Slope range: 0 to 2 percent
Slope features: plane
Organic mat on surface: 1 to 3 inches (2 to 8 cm) thick
Native vegetation: white spruce, aspen, low shrubs, herbs, and moss

Typical profile:
*****0 to 14 inches (0 to 36 cm)—very dark grayish brown, dark grayish brown, and dark yellowish brown silt loam
*****14 to 60 inches (36 to 152 cm)—variegated very gravelly sand stratified with fine sand

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: in the silty loess mantle—moderate; in the gravelly underlying material—rapid
Available water capacity: low
Depth to contrasting gravelly material: 12 to 30 inches (30 to 76 cm)
Runoff: slow
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in similar positions and on narrow, steep escarpments with less than 10 inches (25 cm) of silty loess overlying sandy or gravelly substratums
*soils in similar positions that have clayey material within 10 to 40 inches (25 to 100 cm)
*soils that have slopes of more than 2 percent

Major Uses

Current uses: cropland, hayland and pastureland, low density housing, homesteads, sand and gravel source, and wildlife habitat
Potential uses: forestland

Major Management Factors

Soil-related factors: wind erosion, rapid permeability, available water capacity, and low fertility
Elevation: 900 to 1400 feet (274 to 432 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*soil temperature—30 to 32 °F (-1 to 0 °C) in forested areas and 32 to 35 °F (0 to 2 °C) in cultivated fields (*United States Department of Agriculture 1990)*
*frost-free period—70 to 90 days (28 degree base temperature)

Cropland

General management considerations:
*Suitable crops for planting are climatically adapted vegetables, short season grain varieties, potatoes, and hay.
*Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*Crops respond well to fertilizer if precipitation is adequate.
*Narrow, steep escarpment slopes may limit the size of continuous tillable units.

Suitable management practices:
*Use conservation tillage to conserve moisture.
*Use shallow cuts when land smoothing to avoid exposing gravelly material.
*Rotate crops and use conservation tillage to maintain or improve soil fertility.
*Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*Leave strips of trees as windbreaks when clearing.

Forestland

Principal tree species are: white spruce and quaking aspen
Common understory plants are: pumpkinberry, twinflower, wintergreen, moss, prickly rose, highbush cranberry, and tall willow
Mean site index (100 year site curve) for stated species (and source): white spruce—74 *(Farr 1967),* based on a sample of 70 trees in 14 plots
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—1300 cubic feet/acre; trees greater

than 4.5 inches diameter at breast height—2800 cubic feet/acre *(Farr 1967)*

General management considerations:

*The main limitations for the harvesting of timber are narrow, steep escarpment slopes that may require large cuts and fills when constructing access roads. Cuts and fills will increase the risk of erosion and result in a greater amount of land removed from production.

*Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.

*The upper 12 to 30 inches (30 to 76 cm) of the soil have low bearing capacity and are poor roadbuilding material.

*Road ballast is readily available, generally at depths below 12 to 30 inches (30 to 76 cm).

*If seed trees are in the stand, reforestation occurs naturally in cutover areas.

*Because cold soil temperatures restrict roots, trees are subject to windthrow.

*Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.

*Tree seedlings have a moderate rate of survival because of cold soil temperatures.

*Trees suitable for planting are white spruce.

Suitable management practices:

*Use conventional equipment in harvesting, but limit its use when the soil is wet.

*Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.

*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

General management considerations:

*Cutbanks are not stable and are subject to caving.

*Excavation can expose soil material that is highly susceptible to wind erosion.

*Narrow, steep escarpment slopes may require large cuts and fills when constructing roads. Cuts and fills increase the risk of erosion.

*The rapid permeability of the substratum may allow septic effluent from moderate or high density housing to pollute the ground water.

*This unit is a good source of gravel and a fair source of roadfill.

Suitable management practices:

*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.

*Establish gently sloping grades on cutbanks and excavations to reduce the risk of caving.

*Limit the number of septic systems per area to avoid polluting the ground water.

430—Gulkana silt loam, 2 to 7 percent slopes

Composition

Gulkana silt loam and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Gulkana Soil

Positions on landscape: stream terraces
Slope range: 2 to 7 percent
Slope features: plane
Organic mat on surface: 1 to 3 inches (2 to 8 cm) thick
Native vegetation: white spruce, aspen, low shrubs, herbs, and moss

Typical profile:

*0 to 14 inches (0 to 36 cm)—very dark grayish brown, dark grayish brown, and dark yellowish brown silt loam

*14 to 60 inches (36 to 152 cm)—variegated very gravelly sand stratified with fine sand

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: in the silty loess mantle—moderate; in the gravelly underlying material—rapid
Available water capacity: low
Depth to contrasting gravelly material: 12 to 30 inches (30 to 76 cm)
Runoff: slow
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in similar positions and on narrow, steep escarpments with less than 10 inches (25 cm) of silty loess overlying sandy or gravelly substratums

*soils in similar positions that have clayey material within 10 to 40 inches (25 to 100 cm)

*soils that have slopes of less than 2 percent or more than 7 percent

Major Uses

Current uses: cropland, hayland and pastureland, low density housing, homesteads, sand and gravel source, and wildlife habitat

Potential uses: forestland

Major Management Factors

Soil-related factors: wind erosion, water erosion, rapid permeability, available water capacity, low fertility, and slope
Elevation: 900 to 1400 feet (274 to 432 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****soil temperature—30 to 32 °F (-1 to 0 °C) in forested areas and 32 to 35 °F (0 to 2 °C) in cultivated fields *(United States Department of Agriculture 1990)*
*****frost-free period—70 to 90 days (28 degree base temperature)

Cropland

General management considerations:
*****Suitable crops for planting are climatically adapted vegetables, short season grain varieties, potatoes, and hay.
*****Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*****Crops respond well to fertilizer if precipitation is adequate.
*****Narrow, steep escarpment slopes may limit the size of continuous tillable units.

Suitable management practices:
*****Use conservation tillage to conserve moisture.
*****Use shallow cuts when land smoothing to avoid exposing gravelly material.
*****Rotate crops and use conservation tillage to maintain or improve soil fertility.
*Cultivate and seed on the contour or across the slope and maintain crop residue on or near the surface to reduce the risk of water erosion.
*****Grow row crops in rotation with hay and grain to reduce the hazard of water erosion.
*****Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*****Leave strips of trees as windbreaks when clearing.

Forestland

Principal tree species are: white spruce and quaking aspen
Common understory plants are: pumpkinberry, twinflower, wintergreen, moss, prickly rose, highbush cranberry, and tall willow
Mean site index (100 year site curve) for stated species (and source): white spruce—74 *(Farr 1967),* based on a sample of 70 trees in 14 plots
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—1300 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2800 cubic feet/acre *(Farr 1967)*

General management considerations:
*****The main limitations for the harvesting of timber are narrow, steep escarpment slopes that may require large cuts and fills when constructing access roads. Cuts and fills will increase the risk of erosion and result in a greater amount of land removed from production.
*****Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*****The upper 12 to 30 inches (30 to 76 cm) of the soil have low bearing capacity and are poor roadbuilding material.
*****Road ballast is readily available, generally at depths below 12 to 30 inches (30 to 76 cm).
*****If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*****Because cold soil temperatures restrict roots, trees are subject to windthrow.
*****Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*****Tree seedlings have a moderate rate of survival because of the depth to contrasting gravelly material.
*****Trees suitable for planting are white spruce.

Suitable management practices:
*****Use conventional equipment in harvesting, but limit its use when the soil is wet.
*****Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*****Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

General management considerations:
*****Cutbanks are not stable and are subject to caving.
*****Excavation can expose soil material that is highly susceptible to wind erosion.
*****Excavation increases the risk of water erosion.
*****Narrow, steep escarpment slopes may require large cuts and fills when constructing roads. Cuts and fills increase the risk of erosion.
*****The rapid permeability of the substratum may allow septic effluent from moderate or high density

housing to pollute the ground water.
*This unit is a good source of gravel and a fair source of roadfill.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Establish gently sloping grades on cutbanks and excavations to reduce the risk of caving.
*Limit the number of septic systems per area to avoid polluting the ground water.

431—Gulkana silt loam, 7 to 12 percent slopes

Composition

Gulkana silt loam and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Gulkana Soil

Positions on landscape: stream terraces
Slope range: 7 to 12 percent
Slope features: plane
Organic mat on surface: 1 to 3 inches (2 to 8 cm) thick
Native vegetation: white spruce, aspen, low shrubs, herbs, and moss

Typical profile:
*0 to 14 inches (0 to 36 cm)—very dark grayish brown, dark grayish brown, and dark yellowish brown silt loam
*14 to 60 inches (36 to 152 cm)—variegated very gravelly sand stratified with fine sand

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: in the silty loess mantle—moderate; in the gravelly underlying material—rapid
Available water capacity: low
Depth to contrasting gravelly material: 12 to 30 inches (30 to 76 cm)
Runoff: medium
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in similar positions and on narrow, steep escarpments with less than 10 inches (25 cm) of silty loess overlying sandy or gravelly substratums
*soils in similar positions that have clayey material within 10 to 40 inches (25 to 100 cm)
*soils that have slopes of less than 7 percent or more than 12 percent

Major Uses

Current uses: homesteads, sand and gravel source, and wildlife habitat
Potential uses: hayland and pastureland and forestland

Major Management Factors

Soil-related factors: wind erosion, water erosion, rapid permeability, available water capacity, low fertility, and slope
Elevation: 900 to 1400 feet (274 to 432 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*soil temperature—30 to 32 °F (-1 to 0 °C) in forested areas and 32 to 35 °F (0 to 2 °C) in cultivated fields *(United States Department of Agriculture 1990)*
*frost-free period—70 to 90 days (28 degree base temperature)

Hayland and Pastureland

General management considerations:
*Due to relatively steep slopes, suitable crops for planting are permanent pasture and hay.
*Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*Hay crops respond well to fertilizer if precipitation is adequate.
*Narrow, steep escarpment slopes may limit the size of continuous tillable units.

Suitable management practices:
*Use conservation tillage to conserve moisture.
*Use shallow cuts when land smoothing to avoid exposing gravelly material.
*Seed to permanent hay or pasture, cultivate and seed on the contour or across the slope, and leave native vegetation intact on steeper areas of the unit to reduce the hazard of water erosion.
*Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*Leave strips of trees as windbreaks when clearing.

Forestland

Principal tree species are: white spruce and quaking aspen
Common understory plants are: pumpkinberry, twinflower, wintergreen, moss, prickly rose, highbush cranberry, and tall willow
Mean site index (100 year site curve) for stated species (and source): white spruce—74 *(Farr 1967),* based on a sample of 70 trees in 14 plots
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—1300 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2800 cubic feet/acre *(Farr 1967)*

General management considerations:
*****The main limitations for the harvesting of timber are narrow, steep escarpment slopes that may require large cuts and fills when constructing access roads. Cuts and fills will increase the risk of erosion and result in a greater amount of land removed from production.
*****Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*****The upper 12 to 30 inches (30 to 76 cm) of the soil have low bearing capacity and are poor roadbuilding material.
*****Road ballast is readily available, generally at depths below 12 to 30 inches (30 to 76 cm).
*****If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*****Because cold soil temperatures restrict roots, trees are subject to windthrow.
*****Tree seedlings have a moderate rate of survival because of root restriction by contrasting gravelly material.
*****Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*****Trees suitable for planting are white spruce.

Suitable management practices:
*****Use conventional equipment in harvesting, but limit its use when the soil is wet.
*****Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*****Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

General management considerations:
*****Cutbanks are not stable and are subject to caving.
*****Excavation can expose soil material that is highly susceptible to wind erosion.
*****Excavation increases the risk of water erosion.
*****Narrow, steep escarpment slopes may require large cuts and fills when constructing roads. Cuts and fills increase the risk of erosion.
*****The rapid permeability of the substratum may allow septic effluent from moderate or high density housing to pollute the ground water.
*****This unit is a good source of gravel and a fair source of roadfill.

Suitable management practices:
*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*****Establish gently sloping grades on cutbanks and excavations to reduce the risk of caving.
*****Limit the number of septic systems per area to avoid polluting the ground water.
*Design and construct buildings and access roads to compensate for the steepness of the slope.

432—Gulkana silt loam, 12 to 20 percent slopes

Composition

Gulkana silt loam and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Gulkana Soil

Positions on landscape: stream terraces
Slope range: 12 to 20 percent
Slope features: plane
Organic mat on surface: 1 to 3 inches (2 to 8 cm) thick
Native vegetation: white spruce, aspen, low shrubs, herbs, and moss

Typical profile:
*****0 to 14 inches (0 to 36 cm)—very dark grayish brown, dark grayish brown, and dark yellowish brown silt loam
*****14 to 60 inches (36 to 152 cm)—variegated very gravelly sand stratified with fine sand

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: in the silty loess mantle—moderate; in the gravelly underlying material—rapid
Available water capacity: low
Depth to contrasting gravelly material: 12 to 30 inches (30 to 76 cm)
Runoff: medium
Hazard of erosion: by water—slight if the organic mat

is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in similar positions and on narrow, steep escarpments with less than 10 inches (25 cm) of silty loess overlying sandy or gravelly substratums
*****soils in similar positions that have clayey material within 10 to 40 inches (25 to 100 cm)
*****soils that have slopes of less than 12 percent or more than 20 percent

Major Uses

Current uses: wildlife habitat
Potential uses: sand and gravel sources and forestland

Major Management Factors

Soil-related factors: wind erosion, water erosion, and slope
Elevation: 900 to 1400 feet (274 to 432 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—70 to 90 days (28 degree base temperature)

Forestland

Principal tree species are: white spruce and quaking aspen
Common understory plants are: pumpkinberry, twinflower, wintergreen, moss, prickly rose, highbush cranberry, and tall willow
Site index and yield: not estimated

General management considerations:
*****The main limitation for the harvesting of timber is slope.
*****Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*Adequately designed drainage systems reduce the risk of concentrated flow erosion on roads.
*****The upper 12 to 30 inches (30 to 76 cm) of the soil have low bearing capacity and are poor roadbuilding material.
*****Road ballast is readily available, generally at depths below 12 to 30 inches (30 to 76 cm).
*****If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*****Because cold soil temperatures restrict roots, trees are subject to windthrow.
*****Tree seedlings have a moderate rate of survival because of the depth to contrasting forest materials.
*****Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*****Trees suitable for planting are white spruce.

Suitable management practices:
*****Use conventional equipment in harvesting, but limit its use when the soil is wet.
*****Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*****Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

433—Klawasi peat, 0 to 2 percent slopes

Composition

Klawasi peat and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Characteristics of Klawasi Soil

Positions on landscape: broad lacustrine terraces
Slope range: 0 to 2 percent
Slope features: plane to convex
Organic mat on surface: 9 to 14 inches (23 to 36 cm) thick
Native vegetation: dwarf black and white spruce, low and dwarf shrubs, herbs, and moss

Typical profile:
*****9 inches to 0 (23 cm to 0)—dark reddish brown peat and black mucky peat consisting of fibrous and partially decomposed roots, moss, and twigs
*****0 to 2 inches (0 to 5 cm)—very dark gray mucky silt loam
*****2 to 4 inches (5 to 10 cm)—dark brown silt loam
*****4 to 14 inches (10 to 36 cm)—olive gray silty clay
*****14 to 24 inches (36 to 60 cm)—perennially frozen, olive gray silty clay

Drainage class: very poorly drained or poorly drained
Permeability: in the organic mat—moderately rapid; in the mineral soil above the permafrost—moderate; in the permafrost—impermeable
Available water capacity: including organic mat—low
Root restricting feature: permafrost
Depth to permafrost: 14 to 30 inches (36 to 76 cm) below the surface of the mineral soil

Depth to contrasting clayey material: 1 to 7 inches (3 to 18 cm)
Runoff: slow
Depth to perched water table: 12 to 24 inches (30 to 61 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in similar positions that lack thick organic mats, permafrost, and the associated perched water table within 40 inches (100 cm)
*****soils in muskegs that have over 16 inches (40 cm) of organic material overlying mineral soil
*****soils in similar positions with sandy or very gravelly textures within 40 inches (100 cm) of the mineral surface
*****soils with slopes greater than 2 percent

Major Uses

Current uses: homesteads, low density housing, and wildlife habitat
Potential uses: forestland, cropland, and hayland and pastureland

Major Management Factors

Soil-related factors: wind erosion, available water capacity, depth to permafrost, frost heaving, load supporting capacity, restricted permeability, thermokarst, depth to perched water table, and low fertility
Elevation: 1100 to 1400 feet (335 to 427 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—70 to 90 days (28 degree base temperature)

Cropland

With permafrost:
General management considerations:
*****Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost and subsequent lowering of the water table.
*****Differential subsidence may occur where massive ice features are present.

Suitable management practices:
*****Leave strips of trees as windbreaks when clearing.

When thawed:
General management considerations:
*****Suitable crops for planting include climatically adapted vegetables, short season grain varieties, potatoes, and hay.
*****Additional drainage may be necessary in areas where natural drainage outlets are absent.
*****Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.
*****Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*****Crops respond well to fertilizer if precipitation is adequate.
*****Occasional boulders on the surface may present a hazard to machinery.
*****The high content of strongly granulated clay reduces the amount of moisture available to plants.
*****Small depressional areas comprise up to 10 percent of this unit, remain wet for extended periods in the spring, and may delay cultivation.

Suitable management practices:
*****Use conservation tillage to conserve moisture.
*****Rotate crops and use conservation tillage to maintain or improve soil fertility.
*****Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*****Conduct on-site investigations to determine if massive ice features are present.

Forestland

With permafrost:
Principal tree species are: dwarf black spruce and white spruce
Common understory plants are: Labrador tea ledum, red bearberry, lowbush cranberry, bog blueberry, and moss
Mean site index and yields: not estimated—the presence of permafrost and the associated perched water table result in stunted growth and low site productivity

General management considerations:
*****Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost, lowering of the water table, and increased site productivity.

When thawed:
Principal tree species are: white spruce and quaking aspen
Common understory plants are: soapberry, tall willow, red bearberry, Labrador tea ledum, pumpkinberry, and moss
Estimated site index (100 year site curve) for stated species: white spruce—72
Estimated total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—1100 cubic feet/acre; trees greater than 4.5 inches at breast height—2600 cubic feet/acre *(Farr 1967)*

General management considerations:
*****Productivity of maturing stands may decline significantly as permafrost and the associated perched water table rise within the soil profile.
*****Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*****Logging roads may require ballast.
*****The soil has low bearing capacity and is poor roadbuilding material.
*****Because cold soil temperatures restrict roots, trees are subject to windthrow.
*****Tree seedlings have a moderate rate of survival because of silty clay and clay textures within a 10 inch depth.
*****Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked stand of trees.
*****Trees suitable for planting are white spruce.

Suitable management practices:
*****Use conventional equipment in harvesting, but limit its use when the soil is wet.
*****Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*****Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

With permafrost:
General management considerations:
*****Excavation is hampered by permafrost.
*****Excavation can expose material that is highly susceptible to wind erosion.
*****Frost action limits construction of access roads, driveways, and buildings.
*****Local roads may require a special base to prevent permafrost damage.
*****Septic tank absorption fields may function poorly because of wetness and the limited depth to permafrost, which restrict the movement and infiltration of effluent.

Suitable management practices:
*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*****Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.
*****Construct buildings on thick gravel pads to reduce subsidence caused by the melting of permafrost.
*****Leave the vegetation and organic mat intact where it is desirable to maintain the present level of permafrost.
*****Underlay roads with gravel to minimize frost action.
*****Clearing large areas with obvious surface drainage outlets results in the eventual subsidence of the permafrost and water table to below 60 inches (152 cm).

When thawed:
General management considerations:
*****Excavation can expose material that is highly susceptible to wind erosion.
*****Frost action limits construction of access roads, driveways, and buildings.
*****Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.
*****Depressional areas that comprise up to 10 percent of this unit remain wet after clearing.
*****Septic tank absorption fields may function poorly because of degraded soil structure and reduced permeability upon addition of effluent.

Suitable management practices:
*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*****Provide drainage to reduce wetness if roads and buildings are to be constructed in depressional areas.
*****Consider the depth to which annual frosts penetrate when designing footings and road bases.
*****Increase the size of septic absorption areas to compensate for the restricted permeability.
*****Stockpile topsoil and use it to reclaim areas disturbed during construction.
*****Conduct on-site investigations to determine if massive ice features are present.
*****Underlay roads with gravel to minimize frost action.

434—Klawasi peat, 2 to 7 percent slopes

Composition

Klawasi peat and similar inclusions: 90 percent

Contrasting inclusions: 10 percent

Characteristics of Klawasi Soil

Positions on landscape: broad lacustrine terraces
Slope range: 2 to 7 percent
Slope features: plane
Organic mat on surface: 9 to 14 inches (23 to 36 cm) thick
Native vegetation: dwarf black and white spruce, low and dwarf shrubs, herbs, and moss

Typical profile:
*****9 inches to 0 (23 cm to 0)—dark reddish brown peat and black mucky peat consisting of fibrous and partially decomposed roots, moss, and twigs
*****0 to 2 inches (0 to 5 cm)—very dark gray mucky silt loam
*****2 to 4 inches (5 to 10 cm)—dark brown silt loam
*****4 to 14 inches (10 to 36 cm)—olive gray silty clay
*****14 to 24 inches (36 to 60 cm)—perennially frozen, olive gray silty clay

Drainage class: very poorly drained or poorly drained
Permeability: in the organic mat—moderately rapid; in the mineral soil above the permafrost—moderate; in the permafrost—impermeable
Available water capacity: including organic mat—low
Root restricting feature: permafrost
Depth to permafrost: 14 to 30 inches (36 to 76 cm) below the surface of the mineral soil
Depth to contrasting clayey material: 1 to 7 inches (3 to 18 cm)
Runoff: slow
Depth to perched water table: 12 to 24 inches (30 to 61 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in similar positions that lack thick organic mats, permafrost, and the associated perched water table within 40 inches (100 cm)
*****soils in muskegs that have over 16 inches (40 cm) of organic material overlying mineral soil
*****soils in similar positions with sandy or very gravelly textures within 40 inches (100 cm) of the mineral surface
*****soils with slopes less than 2 percent or greater than 7 percent

Major Uses

Current uses: homesteads, low density housing, and wildlife habitat
Potential uses: forestland, cropland, and hayland and pastureland

Major Management Factors

Soil-related factors: wind erosion, water erosion, available water capacity, depth to permafrost, frost heaving, load supporting capacity, restricted permeability, thermokarst, depth to perched water table, and low fertility
Elevation: 1100 to 1400 feet (335 to 427 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—70 to 90 days (28 degree base temperature)

Cropland

With permafrost:
General management considerations:
*****Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost and subsequent lowering of the water table.
*****Differential subsidence may occur where massive ice features are present.

Suitable management practices:
*****Leave strips of trees as windbreaks when clearing.

When thawed:
General management considerations:
*****Suitable crops for planting include climatically adapted vegetables, short season grain varieties, potatoes, and hay.
*****Additional drainage may be necessary in areas where natural drainage outlets are absent.
*****Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.
*****Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*****Crops respond well to fertilizer if precipitation is adequate.
*****Occasional boulders on the surface may present a hazard to machinery.
*****The high content of strongly granulated clay reduces the amount of moisture available to plants.

Suitable management practices:
*****Use conservation tillage to conserve moisture.
*****Rotate crops and use conservation tillage to maintain or improve soil fertility.
*****Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*****Grow row crops in rotation with hay and grain to reduce the hazard of water erosion.
*****Cultivate and seed on the contour or across the slope and maintain crop residue on or near the surface to reduce the risk of water erosion.
*****Conduct on-site investigations to determine if massive ice features are present.

Forestland

With permafrost:
Principal tree species are: black spruce and white spruce
Common understory plants are: Labrador tea ledum, red bearberry, lowbush cranberry, bog blueberry, and moss
Mean site index and yields: not estimated—the presence of permafrost and the associated perched water table result in stunted growth and low site productivity

General management considerations:
*****Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost, lowering of the water table, and increased site productivity.

When thawed:
Principal tree species are: white spruce and quaking aspen
Common understory plants are: soapberry, tall willow, red bearberry, Labrador tea ledum, pumpkinberry, and moss.
Estimated site index (100 year site curve) for stated species: white spruce—72
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—1100 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2600 cubic feet/acre *(Farr 1967)*

General management considerations:
*****Productivity of maturing stands may decline significantly as permafrost and the associated perched water table rise within the soil profile.
*****Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*****Logging roads may require ballast.
*****The soil has low bearing capacity and is poor roadbuilding material.
*****Because cold soil temperatures restrict roots, trees are subject to windthrow.
*****If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*****Tree seedlings have a moderate rate of survival because of silty clay and clay textures within a 10 inch depth.
*****Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked stand of trees.
*****Trees suitable for planting are white spruce.

Suitable management practices:
*****Use conventional equipment in harvesting, but limit its use when the soil is wet.
*****Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*****Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

With permafrost:
General management considerations:
*****Excavation is hampered by permafrost.
*****Excavation can expose material that is highly susceptible to wind erosion.
*****Excavation increases the risk of water erosion.
*****Frost action limits construction of access roads, driveways, and buildings.
*****Local roads may require a special base to prevent permafrost damage.
*****Septic tank absorption fields may function poorly because of wetness and the limited depth to permafrost, which restrict the movement and infiltration of effluent.

Suitable management practices:
*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*****Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.
*****Construct buildings on thick gravel pads to reduce subsidence caused by the melting of permafrost.
*****Leave the vegetation and organic mat intact where it is desirable to maintain the present level of permafrost.
*****Underlay roads with gravel to minimize frost action.
*****Clearing large areas with obvious surface drainage outlets results in the eventual subsidence of the

permafrost and water table to below 60 inches (152 cm).

When thawed:

General management considerations:

*Excavation can expose material that is highly susceptible to wind erosion.
*Frost action limits construction of access roads, driveways, and buildings.
*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.
*Depressional areas that comprise up to 10 percent of this unit remain wet after clearing.
*Septic tank absorption fields may function poorly because of degraded soil structure and reduced permeability upon addition of effluent.

Suitable management practices:

*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Provide drainage to reduce wetness if roads and buildings are to be constructed in depressional areas.
*Consider the depth to which annual frosts penetrate when designing footings and road bases.
*Increase the size of septic absorption areas to compensate for the restricted permeability.
*Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Conduct on-site investigations to determine if massive ice features are present.
*Underlay roads with gravel to minimize frost action.

435—Klawasi peat, 7 to 12 percent slopes

Composition

Klawasi peat and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Klawasi Soil

Positions on landscape: broad lacustrine terraces
Slope range: 7 to 12 percent
Slope features: plane
Organic mat on surface: 9 to 14 inches (23 to 36 cm) thick
Native vegetation: dwarf black and white spruce, low and dwarf shrubs, herbs, and moss

Typical profile:

*9 inches to 0 (23 cm to 0)—dark reddish brown peat and black mucky peat consisting of fibrous and partially decomposed roots, moss, and twigs
*0 to 2 inches (0 to 5 cm)—very dark gray mucky silt loam
*2 to 4 inches (5 to 10 cm)—dark brown silt loam
*4 to 14 inches (10 to 36 cm)—olive gray silty clay
*14 to 24 inches (36 to 60 cm)—perennially frozen, olive gray silty clay

Drainage class: very poorly drained or poorly drained
Permeability: in the organic mat—moderately rapid; in the mineral soil above the permafrost—moderate; in the permafrost—impermeable
Available water capacity: including organic mat—low
Root restricting feature: permafrost
Depth to permafrost: 14 to 30 inches (36 to 76 cm) below the surface of the mineral soil
Depth to contrasting clayey material: 1 to 7 inches (3 to 18 cm)
Runoff: slow
Depth to perched water table: 12 to 24 inches (30 to 61 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in similar positions that lack thick organic mats, permafrost, and the associated perched water table within 40 inches (100 cm)
*soils in muskegs that have over 16 inches (40 cm) of organic material overlying mineral soil
*soils in similar positions with sandy or very gravelly textures within 40 inches (100 cm) of the mineral surface
*soils with slopes less than 7 percent or greater than 12 percent

Major Uses

Current uses: homesteads and wildlife habitat
Potential uses: forestland and hayland and pastureland

Major Management Factors

Soil-related factors: wind erosion, water erosion, available water capacity, depth to permafrost, frost heaving, load supporting capacity, restricted permeability, thermokarst, slope, depth to perched water table, and low fertility
Elevation: 1100 to 1400 feet (335 to 427 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)

*air temperature—26 °F (-3 °C)
*frost-free period—70 to 90 days (28 degree base temperature)

Hayland and Pastureland

With permafrost:
General management considerations:
*Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost and subsequent lowering of the water table.
*Differential subsidence may occur where massive ice features are present.

Suitable management practices:
*Leave strips of trees as windbreaks when clearing.

When thawed:
General management considerations:
*Due to the relatively steep slopes, suitable crops for planting are permanent pasture and hay.
*Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.
*Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*Hay crops respond well to fertilizer if precipitation is adequate.
*Occasional boulders on the surface may present a hazard to machinery.
*The high content of strongly granulated clay reduces the amount of moisture available to plants.

Suitable management practices:
*Use conservation tillage to conserve moisture and maintain or improve soil fertility.
*Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*Seed to permanent hay or pasture, cultivate and seed on the contour or across the slope, and leave native vegetation intact on steeper areas of the map unit to reduce the hazard of water erosion.
*Conduct on-site investigations to determine if massive ice features are present.

Forestland

With permafrost:
Principal tree species are: black spruce and white spruce
Common understory plants are: Labrador tea ledum, red bearberry, lowbush cranberry, bog blueberry, and moss
Mean site index and yields: not estimated—the presence of permafrost and the associated perched water table result in stunted growth and low site productivity

General management considerations:
*Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost, lowering of the water table, and increased site productivity.

When thawed:
Principal tree species are: white spruce and quaking aspen
Common understory plants are: soapberry, tall willow, red bearberry, Labrador tea ledum, pumpkinberry, and moss
Estimated site index (100 year site curve) for stated species: white spruce—72
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—1100 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2600 cubic feet/acre *(Farr 1967)*

General management considerations:
*Productivity of maturing stands may decline significantly as permafrost and the associated perched water table rise within the soil profile.
*Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*Logging roads may require ballast.
*The soil has low bearing capacity and is poor roadbuilding material.
*Because cold soil temperatures restrict roots, trees are subject to windthrow.
*If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*Tree seedlings have a moderate rate of survival because of silty clay and clay textures within a 10 inch depth.
*Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked stand of trees.
*Trees suitable for planting are white spruce.

Suitable management practices:
*Use conventional equipment in harvesting, but limit its use when the soil is wet.
*Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

With permafrost:
General management considerations:
***Excavation is hampered by permafrost.
***Excavation can expose material that is highly susceptible to wind erosion.
***Excavation increases the risk of water erosion.
***Frost action limits construction of access roads, driveways, and buildings.
***Local roads may require a special base to prevent permafrost damage.
***Road cutbanks are subject to slumping.
***Septic tank absorption fields may function poorly because of wetness and the limited depth to permafrost, which restrict the movement and infiltration of effluent.

Suitable management practices:
***Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
***Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.
***Construct buildings on thick gravel pads to reduce subsidence caused by the melting of permafrost.
***Design and construct buildings and access roads to compensate for the steepness of slope.
***Establish gently sloping grades and revegetate as soon as possible to reduce the risk of slumping.
***Leave the vegetation and organic mat intact where it is desirable to maintain the present level of permafrost.
***Underlay roads with gravel to minimize frost action.
***Clearing large areas with obvious surface drainage outlets results in the eventual subsidence of the permafrost and water table to below 60 inches (152 cm).

When thawed:
General management considerations:
***Excavation can expose material that is highly susceptible to wind erosion.
***Frost action limits construction of access roads, driveways, and buildings.
***Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.
***Excavation increases the risk of water erosion.
***Septic tank absorption fields may function poorly because of degraded soil structure and reduced permeability upon addition of effluent.

Suitable management practices:
***Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
***Design and construct buildings and access roads to compensate for the steepness of slope.
***Consider the depth to which annual frosts penetrate when designing footings and road bases.
***Increase the size of septic absorption areas to compensate for the restricted permeability.
***Install septic absorption lines in adjacent areas that are more nearly level.
***Stockpile topsoil and use it to reclaim areas disturbed during construction.
***Conduct on-site investigations to determine if massive ice features are present.
***Underlay roads with gravel to minimize frost action.

436—Klawasi peat, cool, 0 to 7 percent slopes

Composition

Klawasi peat, cool, and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Characteristics of Klawasi Soil

Positions on landscape: broad lacustrine terraces
Slope range: 0 to 7 percent
Slope features: plane
Organic mat on surface: 9 to 14 inches (23 to 36 cm) thick
Native vegetation: dwarf black and white spruce, low and dwarf shrubs, herbs, and moss

Typical profile:
***9 inches to 0 (23 cm to 0)—dark reddish brown peat and black mucky peat consisting of fibrous and partially decomposed roots, moss, and twigs
***0 to 2 inches (0 to 5 cm)—very dark gray mucky silt loam
***2 to 4 inches (5 to 10 cm)—dark brown silt loam
***4 to 14 inches (10 to 36 cm)—olive gray silty clay
***14 to 24 inches (36 to 60 cm)—perennially frozen, olive gray silty clay

Drainage class: very poorly drained or poorly drained
Permeability: in the organic mat—moderately rapid; in the mineral soil above the permafrost—moderate; in the permafrost—impermeable
Available water capacity: including organic mat—very low
Root restricting feature: permafrost
Depth to permafrost: 14 to 30 inches (36 to 76 cm) below the surface of the mineral soil
Depth to contrasting clayey material: 1 to 7 inches (3 to 18 cm)
Runoff: slow

Depth to perched water table: 12 to 24 inches (30 to 61 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in similar positions that lack thick organic mats, permafrost, and the associated perched water table within 40 inches (100 cm)
*****soils in muskegs that have over 16 inches (40 cm) of organic material overlying mineral soil
*****soils in similar positions with sandy or very gravelly textures within 40 inches (100 cm) of the mineral surface
*****soils with slopes greater than 7 percent

Major Uses

Current uses: homesteads, low density housing, and wildlife habitat
Potential uses: forestland and hayland and pastureland

Major Management Factors

Soil-related factors: wind erosion, water erosion, available water capacity, depth to permafrost, frost heaving, load supporting capacity, restricted permeability, thermokarst, depth to perched water table, and low fertility
Elevation: 1400 to 2000 feet (427 to 610 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—60 to 70 days (28 degree base temperature)

Hayland and Pastureland

With permafrost:
General management considerations:
*****Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost and subsequent lowering of the water table.
*****Differential subsidence may occur where massive ice features are present.

Suitable management practices:
*****Leave strips of trees as windbreaks when clearing.

When thawed:
General management considerations:
*****Due to frequent mid-summer frosts and a relatively short frost-free season, the suitable crops for planting are hay, permanent pasture, and grain crops harvested as hay.
*****Small depressional areas that comprise up to 10 percent of this unit remain wet for extended periods in the spring and may delay cultivation.
*****Additional drainage may be necessary in areas where natural drainage outlets are absent.
*****Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.
*****Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*****Hay crops respond well to fertilizer if precipitation is adequate.
*****Occasional boulders on the surface may present a hazard to machinery.
*****The high content of strongly granulated clay reduces the amount of moisture available to plants.

Suitable management practices:
*****Use conservation tillage to conserve moisture and maintain or improve soil fertility.
*****Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*****Seed to permanent hay or pasture, cultivate and seed on the contour or across the slope, and maintain crop residue on or near the surface to reduce the hazard of water erosion.
*****Conduct on-site investigations to determine if massive ice features are present.

Forestland

With permafrost:
Principal tree species are: black spruce and white spruce
Common understory plants are: Labrador tea ledum, red bearberry, lowbush cranberry, bog blueberry, and moss
Mean site index and yields: not estimated—the presence of permafrost and the associated perched water table result in stunted growth and low site productivity

General management considerations:
*****Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost,

lowering of the water table, and increased site productivity.

When thawed:

Principal tree species are: white spruce and quaking aspen

Common understory plants are: soapberry, tall willow, red bearberry, Labrador tea ledum, pumpkinberry, and moss

Site index and yields: not estimated

General management considerations:

*****Productivity of maturing stands may decline significantly as permafrost and the associated perched water table rise within the soil profile.

*****Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.

*****Logging roads may require ballast.

*****The soil has low bearing capacity and is poor roadbuilding material.

*****Because cold soil temperatures restrict roots, trees are subject to windthrow.

*****If seed trees are in the stand, reforestation occurs naturally in cutover areas.

*****Tree seedlings have a moderate rate of survival because of silty clay and clay textures within a 10 inch depth.

*****Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked stand of trees.

*****Trees suitable for planting are white spruce.

Suitable management practices:

*****Use conventional equipment in harvesting, but limit its use when the soil is wet.

*****Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.

*****Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

With permafrost:

General management considerations:

*****Excavation is hampered by permafrost.

*****Excavation can expose material that is highly susceptible to wind erosion.

*****Excavation increases the risk of water erosion.

*****Frost action limits construction of access roads, driveways, and buildings.

*****Local roads may require a special base to prevent permafrost damage.

*****Septic tank absorption fields may function poorly because of wetness and the limited depth to permafrost, which restrict the movement and infiltration of effluent.

Suitable management practices:

*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.

*****Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.

*****Construct buildings on thick gravel pads to reduce subsidence caused by the melting of permafrost.

*****Leave the vegetation and organic mat intact where it is desirable to maintain the present level of permafrost.

*****Underlay roads with gravel to minimize frost action.

*****Clearing large areas with obvious surface drainage outlets results in the eventual subsidence of the permafrost and water table to below 60 inches (152 cm).

When thawed:

General management considerations:

*****Excavation can expose material that is highly susceptible to wind erosion.

*****Excavation increases the risk of water erosion.

*****Frost action limits construction of access roads, driveways, and buildings.

*****Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.

*****Depressional areas that comprise up to 10 percent of this unit remain wet after clearing.

*****Septic tank absorption fields may function poorly because of degraded soil structure and reduced permeability upon addition of effluent.

Suitable management practices:

*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.

*****Provide drainage to reduce wetness if roads and buildings are to be constructed in depressional areas.

*****Consider the depth to which annual frosts penetrate when designing footings and road bases.

*****Increase the size of septic absorption areas to compensate for the restricted permeability.

*****Stockpile topsoil and use it to reclaim areas disturbed during construction.

*****Conduct on-site investigations to determine if massive ice features are present.

*****Underlay roads with gravel to minimize frost action.

437—Klawasi peat, cool, 7 to 20 percent slopes

Composition

Klawasi peat, cool, and similar inclusions: 90 percent

Contrasting inclusions: 10 percent

Characteristics of Klawasi Soil

Positions on landscape: broad lacustrine terraces
Slope range: 7 to 20 percent
Slope features: plane
Organic mat on surface: 9 to 14 inches (23 to 36 cm) thick
Native vegetation: dwarf black and white spruce, low and dwarf shrubs, herbs, and moss

Typical profile:
*****9 inches to 0 (23 cm to 0)—dark reddish brown peat and black mucky peat consisting of fibrous and partially decomposed roots, moss, and twigs
*****0 to 2 inches (0 to 5 cm)—very dark gray mucky silt loam
*****2 to 4 inches (5 to 10 cm)—dark brown silt loam
*****4 to 14 inches (10 to 36 cm)—olive gray silty clay
*****14 to 24 inches (36 to 60 cm)—perennially frozen, olive gray silty clay

Drainage class: very poorly drained or poorly drained
Permeability: in the organic mat—moderately rapid; in the mineral soil above the permafrost—moderate; in the permafrost—impermeable
Available water capacity: including organic mat—low
Root restricting feature: permafrost
Depth to permafrost: 14 to 30 inches (36 to 76 cm) below the surface of the mineral soil
Depth to contrasting clayey material: 1 to 7 inches (3 to 18 cm)
Runoff: medium
Depth to perched water table: 12 to 24 inches (30 to 61 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, severe if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in similar positions that lack thick organic mats, permafrost, and the associated perched water table within 40 inches (100 cm)
*****soils in muskegs that have over 16 inches (40 cm) of organic material overlying mineral soil
*****soils in similar positions with sandy or very gravelly textures within 40 inches (100 cm) of the mineral surface
*****soils with slopes of less than 7 percent or greater than 20 percent

Major Uses

Current uses: wildlife habitat
Potential uses: homesteads and hayland and pastureland

Major Management Factors

Soil-related factors: wind erosion, water erosion, available water capacity, depth to permafrost, frost heaving, load supporting capacity, restricted permeability, thermokarst, depth to perched water table, slope, and low fertility
Elevation: 1400 to 2000 feet (427 to 610 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °0.)
*****frost-free period—60 to 70 days (28 degree base temperature)

Hayland and Pastureland

With permafrost:
General management considerations:
*****Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost and subsequent lowering of the water table.
*****Differential subsidence may occur where massive ice features are present.

Suitable management practices:
*****Leave strips of trees as windbreaks when clearing.

When thawed:
General management considerations:
*****Due to frequent mid-summer frosts, a relatively short frost-free season, and steep slopes, the suitable crops for planting are permanent pasture and hay.
*****Additional drainage may be necessary in areas where natural drainage outlets are absent.
*****Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.
*****Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*****Hay crops respond well to fertilizer if precipitation is adequate.
*****Occasional boulders on the surface may present a hazard to machinery.
*****The high content of strongly granulated clay reduces the amount of moisture available to plants.

Suitable management practices:
*****Use conservation tillage to conserve moisture and

maintain or improve soil fertility.
*Seed to permanent hay or pasture, cultivate and seed on the contour or across the slope, and leave native vegetation intact on steeper areas of this unit to reduce the risk of water erosion.
*Conduct on-site investigations to determine if massive ice features are present.
*Maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.

Forestland

With permafrost:
Principal tree species are: black spruce and white spruce
Common understory plants are: Labrador tea ledum, red bearberry, lowbush cranberry, bog blueberry, and moss
Mean site index and yields: not estimated—the presence of permafrost and the associated perched water table result in stunted growth and low site productivity

General management considerations:
*Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost, lowering of the water table, and increased site productivity.

When thawed:
Principal tree species are: white spruce and quaking aspen
Common understory plants are: soapberry, tall willow, red bearberry, Labrador tea ledum, pumpkinberry, and moss
Site index and yields: not estimated

General management considerations:
*Productivity of maturing stands may decline significantly as permafrost and the associated perched water table rise within the soil profile.
*The main limitation for the harvesting of timber is slope.
*Logging roads may require ballast.
*Adequately designed drainage systems reduce the risk of concentrated flow erosion on roadways.
*The soil has low bearing capacity and is poor roadbuilding material.
*Because cold soil temperatures restrict roots, trees are subject to windthrow.
*If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*Tree seedlings have a moderate rate of survival because of silty clay and clay textures within a 10 inch depth.
*Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked stand of trees.
*Trees suitable for planting are white spruce.

Suitable management practices:
*Use conventional equipment in harvesting, but limit its use when the soil is wet.
*Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

With permafrost:
General management considerations:
*Excavation is hampered by permafrost.
*Excavation can expose material that is highly susceptible to wind erosion.
*Excavation increases the risk of water erosion.
*Frost action limits construction of access roads, driveways, and buildings.
*Local roads may require a special base to prevent permafrost damage.
*Road cutbanks are subject to slumping.
*Septic tank absorption fields may function poorly because of wetness and the limited depth to permafrost, which restrict the movement and infiltration of effluent.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.
*Construct buildings on thick gravel pads to reduce subsidence caused by the melting of permafrost.
*Design and construct buildings and access roads to compensate for slope.
*Establish gently sloping grades and revegetate as soon as possible to reduce the risk of slumping.
*Leave the vegetation and organic mat intact where it is desirable to maintain the present level of permafrost.
*Underlay roads with gravel to minimize frost action.
*Clearing large areas with obvious surface drainage outlets results in the eventual subsidence of the permafrost and water table to below 60 inches (152 cm).

When thawed:
General management considerations:
*Excavation can expose material that is highly susceptible to wind erosion.

*Excavation increases the risk of water erosion.
*Frost action limits construction of access roads, driveways, and buildings.
*Road cutbanks are subject to slumping.
*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.
*Septic tank absorption fields may function poorly because of degraded soil structure and reduced permeability upon addition of effluent.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Consider the depth to which annual frosts penetrate when designing footings and road bases.
*Design and construct buildings and access roads to compensate for steepness of slope.
*Increase the size of septic absorption areas to compensate for the restricted permeability.
*Install septic absorption lines in adjacent areas that are more nearly level.
*Establish gently sloping grades and revegetate as soon as possible to reduce the risk of slumping.
*Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Conduct on-site investigations to determine if massive ice features are present.
*Underlay roads with gravel to minimize frost action.

438—Klawasi peat, depressional, 0 to 2 percent slopes

Composition

Klawasi peat, depressional, and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Klawasi Soil

Positions on landscape: broad lacustrine terraces
Microtopography: depressions
Slope range: 0 to 2 percent
Slope features: concave
Organic mat on surface: 9 to 14 inches (23 to 36 cm) thick
Native vegetation: dwarf black and white spruce, low and dwarf shrubs, willows, sedges, grasses, and moss

Typical profile:
*9 inches to 0 (23 cm to 0)—dark reddish brown peat and black mucky peat consisting of fibrous and partially decomposed roots, moss, and twigs
*0 to 2 inches (0 to 5 cm)—very dark gray mucky silt loam
*2 to 4 inches (5 to 10 cm)—dark brown silt loam
*4 to 14 inches (10 to 36 cm)—olive gray silty clay
*14 to 24 inches (36 to 60 cm)—perennially frozen, olive gray silty clay

Drainage class: very poorly drained
Permeability: in the organic mat—moderately rapid; in the mineral soil above the permafrost—moderate; in the permafrost—impermeable
Available water capacity: including organic mat—low
Root restricting feature: permafrost
Depth to permafrost: 14 to 30 inches (36 to 76 cm) below the surface of the mineral soil
Depth to contrasting clayey material: 1 to 7 inches (3 to 18 cm)
Runoff: very slow
Depth to perched water table: 0 to 9 inches (0 to 23 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, slight if the mat is removed
Hazard of flooding: none

Included Areas

*soils in convex positions that lack permafrost and the associated perched water table in the surface 4 inches (100 cm)
*soils in similar positions that have over 16 inches (40 cm) of organic material overlying mineral soil or permafrost
*water
*soils with slopes greater than 2 percent

Major Uses

Current uses: wildlife habitat

Major Management Factors

Elevation: 1100 to 1400 feet (335 to 427 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*frost-free period—70 to 90 days (28 degree base temperature)

General management considerations:
*This soil is located in depressions with few or no drainage outlets.
*Subsidence of the permafrost may occur after surface disturbance; however, the shallow water table will persist.

439—Gakona silt loam, cool, 0 to 7 percent slopes

Composition

Gakona silt loam, cool, and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Gakona Soil

Positions on landscape: broad lacustrine terraces
Slope range: 0 to 7 percent
Slope features: plane
Organic mat on surface: 1 to 3 inches (2 to 8 cm) thick
Native vegetation: white spruce, aspen, tall willow, low and dwarf shrubs, and herbs

Typical profile:
*****0 to 5 inches (0 to 13 cm)—very dark grayish brown and dark grayish brown silt loam
*****5 to 60 inches (13 to 152 cm)—dark grayish brown, olive gray, and dark gray silty clay

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: low
Depth to contrasting clayey material: 1 to 8 inches (2 to 20 cm)
Runoff: slow
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in similar positions and muskegs with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*****soils in similar positions that have very gravelly or sandy material within 40 inches (100 cm)
*****soils that have slopes of more than 7 percent

Major Uses

Current uses: homesteads and wildlife habitat
Potential uses: hayland and pastureland and forestland

Major Management Factors

Soil-related factors: wind erosion, water erosion, frost heaving, load supporting capacity, restricted permeability, and low fertility
Elevation: 1400 to 2000 feet (427 to 610 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—60 to 70 days (28 degree base temperature)

Hayland and Pastureland

General management considerations:
*****Due to frequent mid-summer frosts and a relatively short frost-free season, the suitable crops for planting are hay, permanent pasture, and grain crops harvested as hay.
*****Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*****Hay crops respond well to fertilizer if precipitation is adequate.
*****The high content of strongly granulated clay reduces the amount of moisture available to plants.
*****Occasional boulders and cobbles may present a hazard to machinery.
*****Small depressional areas that comprise up to 10 percent of this unit remain wet for extended periods in the spring and may delay cultivation.
*Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.

Suitable management practices:
*****Use conservation tillage to conserve moisture.
*****Seed to permanent hay or pasture, cultivate and seed on the contour or across the slope, and maintain crop residue on or near the surface to reduce the risk of water erosion.
*****Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*****Leave strips of trees as windbreaks when clearing.
*****Conduct on-site investigations to determine if deep massive ice features are present.

Forestland

Principal tree species are: white spruce and quaking aspen
Common understory plants are: tall willow, soapberry, red bearberry, pumpkinberry, lowbush cranberry, and moss
Site index and yields: not estimated

General management considerations:

*Productivity of maturing stands may decline significantly as permafrost and the associated perched water table rise within the soil profile.
*Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*Logging roads may require ballast.
*The soil has low bearing capacity and is a poor source of roadbuilding material.
*Because cold soil temperatures restrict roots, trees are subject to windthrow.
*Tree seedlings have a moderate rate of survival because of silty clay and clay textures within a depth of 10 inches.
*Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*Trees suitable for planting are white spruce.

Suitable management practices:

*Use conventional equipment in harvesting, but limit its use when the soil is wet.
*Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

General management considerations:

*Excavation can expose soil material that is highly susceptible to wind erosion.
*Excavation increases the risk of water erosion.
*Frost action limits the construction of access roads, driveways, and buildings.
*Septic tank absorption fields may function poorly because of degraded soil structure and reduced permeability upon addition of effluent.
*Differential subsidence may occur in areas where deep massive ice features are present. Subsidence may occur for several years following soil disturbance.

Suitable management practices:

*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Increase the size of the septic absorption area to compensate for the restricted permeability.
*Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Consider the depth to which annual frosts penetrate when designing footings and road bases.
*Conduct on-site investigations to determine if massive ice features are present.
*Underlay roads with gravel to minimize frost action.

440—Gakona silt loam, cool, 7 to 20 percent slopes

Composition

Gakona silt loam, cool, and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Characteristics of Gakona Soil

Positions on landscape: broad lacustrine terraces
Microtopography: hills
Slope range: 7 to 20 percent
Slope features: plane
Organic mat on surface: 2 to 5 inches (5 to 12 cm) thick
Native vegetation: white spruce, aspen, tall willow, low and dwarf shrubs, and herbs

Typical profile:

*0 to 5 inches (0 to 13 cm)—very dark grayish brown and dark grayish brown silt loam
*5 to 60 inches (13 to 152 cm)—dark grayish brown, olive gray, and dark gray silty clay

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: low
Depth to contrasting clayey material: 1 to 8 inches (2 to 20 cm)
Runoff: medium
Hazard of erosion: by water—slight if the organic mat is not removed, severe if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in similar positions and muskegs with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*soils in similar positions that have very gravelly or sandy material within 40 inches (100 cm)
*soils that have slopes of less than 7 percent or more than 20 percent

Major Uses

Current uses: homesteads and wildlife habitat

Potential uses: hayland and pastureland and forestland

Major Management Factors

Soil-related factors: wind erosion, water erosion, slope, frost heaving, load supporting capacity, restricted permeability, and low fertility

Elevation: 1400 to 2000 feet (427 to 610 m)

Climatic factors (average annual):

*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)

*****air temperature—26 °F (-3 °C)

*****frost-free period—60 to 70 days (28 degree base temperature)

Hayland and Pastureland

General management considerations:

*****Due to frequent mid-summer frosts, a relatively short frost-free season, and steep slopes, the suitable crops for planting are permanent pasture and hay.

*****Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.

*****Hay crops respond well to fertilizer if precipitation is adequate.

*****The high content of strongly granulated clay reduces the amount of moisture available to plants.

*****Occasional boulders and cobbles may present a hazard to machinery.

*****Additional drainage may be necessary in areas where natural drainage outlets are absent.

*Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.

Suitable management practices:

*****Use conservation tillage to conserve moisture.

*****Seed to permanent hay or pasture, cultivate and seed on the contour or across the slope, and leave native vegetation intact on steeper areas of this unit to reduce the risk of water erosion.

*****Leave strips of trees as windbreaks when clearing.

*****Conduct on-site investigations to determine if deep massive ice features are present.

*Maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.

Forestland

Principal tree species are: white spruce and quaking aspen

Common understory plants are: tall willow, soapberry, red bearberry, pumpkinberry, lowbush cranberry, and moss

Site index and yields: not estimated

General management considerations:

*****Productivity of maturing stands may decline significantly as permafrost and the associated perched water table rise within the soil profile.

*****The main limitation for the harvesting of timber is slope.

*****Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.

*****Logging roads may require ballast.

*****Adequately designed drainage systems reduce the risk of concentrated flow erosion on roadways.

*****The soil has low bearing capacity and is a poor source of roadbuilding material.

*****Because cold soil temperatures restrict roots, trees are subject to windthrow.

*****Tree seedlings have a moderate rate of survival because of silty clay and clay textures at depths less than 10 inches.

*****Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.

*****Trees suitable for planting are white spruce.

Suitable management practices:

*****Use conventional equipment in harvesting, but limit its use when the soil is wet.

*****Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.

*****Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

General management considerations:

*****Excavation can expose soil material that is highly susceptible to wind erosion.

*****Excavation increases the risk of water erosion.

*****Frost action limits the construction of access roads, driveways, and buildings.

*****Road cutbanks are subject to slumping.

*****Septic tank absorption fields may function poorly because of degraded soil structure and reduced permeability upon addition of effluent.

*****Differential subsidence may occur in areas where deep massive ice features are present. Subsidence may occur for several years following soil disturbance.

Suitable management practices:

*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.

*****Design and construct buildings and access roads to compensate for the steepness of slope.

*****Install septic absorption lines in adjacent areas that are more nearly level.

*Locate roads in more gently sloping areas, and design drainage systems to minimize the risk of slumping.
*Increase the size of the septic absorption area to compensate for the restricted permeability.
*Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Consider the depth to which annual frosts penetrate when designing footings and road bases.
*Conduct on-site investigations to determine if massive ice features are present.
*Underlay roads with gravel to minimize frost action.

441—Gakona silt loam, 0 to 2 percent slopes

Composition

Gakona silt loam, and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Characteristics of Gakona Soil

Positions on landscape: broad lacustrine terraces
Slope range: 0 to 2 percent
Slope features: plane
Organic mat on surface: 1 to 5 inches (2 to 12 cm) thick
Native vegetation: white spruce, aspen, tall willow, low and dwarf shrubs, and herbs

Typical profile:
*0 to 5 inches (0 to 13 cm)—very dark grayish brown and dark grayish brown silt loam
*5 to 60 inches (13 to 152 cm)—dark grayish brown, olive gray, and dark gray silty clay

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: low
Depth to contrasting clayey material: 1 to 8 inches (2 to 20 cm)
Runoff: slow
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in similar positions and muskegs with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*soils in similar positions that have very gravelly or sandy material within 40 inches (100 cm)
*soils that have slopes of more than 2 percent

Major Uses

Current uses: homesteads, low density housing, cropland, and hayland and pastureland
Potential uses: forestland

Major Management Factors

Soil-related factors: wind erosion, frost heaving, load supporting capacity, restricted permeability, and low fertility
Elevation: 1100 to 1400 feet (335 to 427 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*soil temperature—31 °F (0 °C) under aspen and spruce forest; 34 °F (1 °C) in cultivated fields *(United States Department of Agriculture 1990)*
*frost-free period—70 to 90 days (28 degree base temperature)

Cropland

General management considerations:
*Suitable crops for planting are climatically adapted vegetables, short season grain varieties, potatoes, and hay.
*Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*Crops respond well to fertilizer if precipitation is adequate.
*The high content of strongly granulated clay reduces the amount of moisture available to plants.
*Occasional boulders and cobbles may present a hazard to machinery.
*Small depressional areas that comprise up to 10 percent of this unit remain wet for extended periods in the spring and may delay cultivation.
*Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.

Suitable management practices:
*Use conservation tillage to conserve moisture.
*Rotate crops and use conservation tillage to maintain or improve soil fertility.
*Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width

of strips of unprotected soils to reduce the risk of wind erosion.
*Leave strips of trees as windbreaks when clearing.
*Conduct on-site investigations to determine if deep massive ice features are present.

Forestland

Principal tree species are: white spruce and quaking aspen
Common understory plants are: tall willow, soapberry, red bearberry, pumpkinberry, lowbush cranberry, and moss
Mean site index (100 year site curve) for stated species (and source): white spruce—72 *(Farr 1967),* based on a sample of 26 trees in 5 plots
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—1100 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2600 cubic feet/acre *(Farr 1967)*

General management considerations:
*Productivity of maturing stands may decline significantly as permafrost and the associated perched water table rise within the soil profile.
*Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*Logging roads may require ballast.
*The soil has low bearing capacity and is a poor source of roadbuilding material.
*Because cold soil temperatures restrict roots, trees are subject to windthrow.
*If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*Tree seedlings have a moderate rate of survival because of silty clay and clay textures at depths less than 10 inches.
*Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*Trees suitable for planting are white spruce.

Suitable management practices:
*Use conventional equipment in harvesting, but limit its use when the soil is wet.
*Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

General management considerations:
*Excavation can expose soil material that is highly susceptible to wind erosion.
*Frost action limits the construction of access roads, driveways, and buildings.
*Septic tank absorption fields may function poorly because of degraded soil structure and reduced permeability upon addition of effluent.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Increase the size of the septic absorption area to compensate for the restricted permeability.
*Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Consider the depth to which annual frosts penetrate when designing footings and road bases.
*Conduct on-site investigations to determine if massive ice features are present.
*Underlay roads with gravel to minimize frost action.

442—Gakona silt loam, 2 to 7 percent slopes

Composition

Gakona silt loam, and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Characteristics of Gakona Soil

Positions on landscape: broad lacustrine terraces
Slope range: 2 to 7 percent
Slope features: plane
Organic mat on surface: 1 to 5 inches (2 to 12 cm) thick
Native vegetation: white spruce, aspen, tall willow, low and dwarf shrubs, and herbs

Typical profile:
*0 to 5 inches (0 to 13 cm)—very dark grayish brown and dark grayish brown silt loam
*5 to 60 inches (13 to 152 cm)—dark grayish brown, olive gray, and dark gray silty clay

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: low
Depth to contrasting clayey material: 1 to 8 inches (2 to 20 cm)
Runoff: slow
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed,

severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in similar positions and muskegs with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*soils in similar positions that have very gravelly or sandy material within 40 inches (100 cm)
*soils that have slopes of less than 2 percent or more than 7 percent

Major Uses

Current uses: homesteads, low density housing, cropland, hayland and pastureland, and wildlife habitat
Potential uses: forestland

Major Management Factors

Soil-related factors: wind erosion, water erosion, frost heaving, load supporting capacity, restricted permeability, and low fertility
Elevation: 1100 to 1400 feet (335 to 427 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*soil temperature—31 °F (0 °C) under aspen and spruce forest; 34 °F (1 °C) in cultivated fields *(United States Department of Agriculture 1990)*
*frost-free period—70 to 90 days (28 degree base temperature)

Cropland

General management considerations:
*Suitable crops for planting are climatically adapted vegetables, short season grain varieties, potatoes, and hay.
*Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*Crops respond well to fertilizer if precipitation is adequate.
*The high content of strongly granulated clay reduces the amount of moisture available to plants.
*Occasional boulders and cobbles may present a hazard to machinery.
*Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.

Suitable management practices:
*Use conservation tillage to conserve moisture.
*Rotate crops and use conservation tillage to maintain or improve soil fertility.
*Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*Grow row crops in rotation with hay and grain to reduce the hazard of water erosion.
*Cultivate and seed on the contour or across the slope and maintain crop residue on the surface to reduce the risk of water erosion.
*Leave strips of trees as windbreaks when clearing.
*Conduct on-site investigations to determine if deep massive ice features are present.

Forestland

Principal tree species are: white spruce and quaking aspen
Common understory plants are: tall willow, soapberry, red bearberry, pumpkinberry, lowbush cranberry, and moss
Mean site index (100 year site curve) for stated species (and source): white spruce—72 *(Farr 1967),* based on a sample of 26 trees in 5 plots
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—1100 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2600 cubic feet/acre *(Farr 1967)*

General management considerations:
*Productivity of maturing stands may decline significantly as permafrost and the associated perched water table rise within the soil profile.
*Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*Logging roads may require ballast.
*The soil has low bearing capacity and is a poor source of roadbuilding material.
*Because cold soil temperatures restrict roots, trees are subject to windthrow.
*If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*Tree seedlings have a moderate rate of survival because of silty clay and clay textures at depths less than 10 inches.
*Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.

*Trees suitable for planting are white spruce.

Suitable management practices:
*Use conventional equipment in harvesting, but limit its use when the soil is wet.
*Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

General management considerations:
*Excavation can expose soil material that is highly susceptible to wind erosion.
*Excavation increases the risk of water erosion.
*Frost action limits the construction of access roads, driveways, and buildings.
*Septic tank absorption fields may function poorly because of degraded soil structure and reduced permeability upon addition of effluent.
*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Increase the size of the septic absorption area to compensate for the restricted permeability.
*Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Consider the depth to which annual frosts penetrate when designing footings and road bases.
*Conduct on-site investigations to determine if massive ice features are present.
*Underlay roads with gravel to minimize frost action.

443—Gakona silt loam, 7 to 12 percent slopes

Composition

Gakona silt loam, and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Characteristics of Gakona Soil

Positions on landscape: broad lacustrine terraces
Slope range: 7 to 12 percent
Slope features: plane
Organic mat on surface: 1 to 5 inches (2 to 12 cm) thick
Native vegetation: white spruce, aspen, tall willow, low and dwarf shrubs, and herbs

Typical profile:
*0 to 5 inches (0 to 13 cm)—very dark grayish brown and dark grayish brown silt loam
*5 to 60 inches (13 to 152 cm)—dark grayish brown, olive gray, and dark gray silty clay

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: low
Depth to contrasting clayey material: 1 to 8 inches (2 to 20 cm)
Runoff: medium
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in similar positions and muskegs with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*soils in similar positions that have very gravelly or sandy material within 40 inches (100 cm)
*soils that have slopes of less than 7 percent or more than 12 percent

Major Uses

Current uses: homesteads and wildlife habitat
Potential uses: forestland and hayland and pastureland

Major Management Factors

Soil-related factors: wind erosion, water erosion, frost heaving, slope, load supporting capacity, restricted permeability, and low fertility
Elevation: 1100 to 1400 feet (335 to 427 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*soil temperature—31 °F (0 °C) under aspen and spruce forest; 34 °F (1 °C) in cultivated fields *(United States Department of Agriculture 1990)*
*frost-free period—70 to 90 days (28 degree base temperature)

Hayland and Pastureland

General management considerations:
*Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.

*****Hay crops respond well to fertilizer if precipitation is adequate.
*****The high content of strongly granulated clay reduces the amount of moisture available to plants.
*****Occasional boulders and cobbles may present a hazard to machinery.
*Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.

Suitable management practices:
*****Use conservation tillage to conserve moisture.
*****Maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*****Seed to permanent hay or pasture, cultivate and seed on the contour or across the slope, and leave native vegetation intact on steeper areas of the unit to reduce the risk of water erosion.
*****Leave strips of trees as windbreaks when clearing.
*****Conduct on-site investigations to determine if deep massive ice features are present.

Forestland

Principal tree species are: white spruce and quaking aspen
Common understory plants are: tall willow, soapberry, red bearberry, pumpkinberry, lowbush cranberry, and moss
Mean site index (100 year site curve) for stated species (and source): white spruce—72 *(Farr 1967),* based on a sample of 26 trees in 5 plots
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—1100 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2600 cubic feet/acre *(Farr 1967)*

General management considerations:
*****Productivity of maturing stands may decline significantly as permafrost and the associated perched water table rise within the soil profile.
*****Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*****Logging roads may require ballast.
*****The soil has low bearing capacity and is a poor source of roadbuilding material.
*****Because cold soil temperatures restrict roots, trees are subject to windthrow.
*****If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*****Tree seedlings have a moderate rate of survival because of silty clay and clay textures at depths less than 10 inches.
*****Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*****Trees suitable for planting are white spruce.

Suitable management practices:
*****Use conventional equipment in harvesting, but limit its use when the soil is wet.
*****Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*****Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

General management considerations:
*****Excavation can expose soil material that is highly susceptible to wind erosion.
*****Excavation increases the risk of water erosion.
*****Frost action limits the construction of access roads, driveways, and buildings.
*****Septic tank absorption fields may function poorly because of degraded soil structure and reduced permeability upon addition of effluent.
*****Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.

Suitable management practices:
*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*****Design and construct buildings and access roads to compensate for the steepness of slope.
*****Install septic absorption lines in adjacent areas that are more nearly level.
*****Increase the size of the septic absorption area to compensate for the restricted permeability.
*****Stockpile topsoil and use it to reclaim areas disturbed during construction.
*****Consider the depth to which annual frosts penetrate when designing footings and road bases.
*****Conduct on-site investigations to determine if massive ice features are present.
*****Underlay roads with gravel to minimize frost action.

444—Gakona silt loam, 12 to 20 percent slopes

Composition

Gakona silt loam, and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Gakona Soil

Positions on landscape: broad lacustrine terraces
Slope range: 12 to 20 percent
Slope features: plane
Organic mat on surface: 1 to 5 inches (2 to 12 cm) thick
Native vegetation: white spruce, aspen, tall willow, low and dwarf shrubs, and herbs

Typical profile:
*****0 to 5 inches (0 to 13 cm)—very dark grayish brown and dark grayish brown silt loam
*****5 to 60 inches (13 to 152 cm)—dark grayish brown, olive gray, and dark gray silty clay

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: low
Depth to contrasting clayey material: 1 to 8 inches (2 to 20 cm)
Runoff: rapid
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in similar positions and muskegs with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*****soils in similar positions that have very gravelly or sandy material within 40 inches (100 cm)
*****soils that have slopes of less than 12 percent or more than 20 percent

Major Uses

Current uses: wildlife habitat
Potential uses: forestland

Major Management Factors

Soil-related factors: wind erosion, water erosion, and slope
Elevation: 1100 to 1400 feet (335 to 427 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—70 to 90 days (28 degree base temperature)

Forestland

Principal tree species are: white spruce and quaking aspen
Common understory plants are: tall willow, soapberry, red bearberry, pumpkinberry, lowbush cranberry, and moss
Site index and yields: not estimated

General management considerations:
*****Productivity of maturing stands may decline significantly as permafrost and the associated perched water table rise within the soil profile.
*****The main limitation for the harvesting of timber is slope.
*****Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*****Logging roads may require ballast.
*Adequately designed drainage systems reduce the risk of concentrated flow erosion on roads.
*****The soil has low bearing capacity and is a poor source of roadbuilding material.
*****Because cold soil temperatures restrict roots, trees are subject to windthrow.
*****If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*****Tree seedlings have a moderate rate of survival because of silty clay and clay textures at depths less than 10 inches.
*****Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*****Trees suitable for planting are white spruce.

Suitable management practices:
*****Use conventional equipment in harvesting, but limit its use when the soil is wet.
*****Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*****Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

445—Klawasi-Tolsona complex, 0 to 2 percent slopes

Composition

Klawasi peat and similar inclusions: 50 percent
Tolsona peat and similar inclusions: 35 percent
Contrasting inclusions: 15 percent

Characteristics of Klawasi Soil

Positions on landscape: broad lacustrine terraces
Slope range: 0 to 2 percent

Slope features: plane
Organic mat on surface: 9 to 14 inches (23 to 36 cm) thick
Native vegetation: dwarf black and white spruce, low and dwarf shrubs, herbs, and moss

Typical profile:
*****10 inches to 0 (25 cm to 0)—dark brown peat and black mucky peat consisting of fibrous and partially decomposed roots, moss, and twigs
*****0 to 1 inch (0 to 2 cm)—very dark brown mucky silt loam
*****1 to 15 inches (2 to 38 cm)—olive gray silty clay
*****15 to 25 inches (38 to 64 cm)—perennially frozen, olive gray silty clay

Drainage class: very poorly drained or poorly drained
Permeability: in the organic mat—moderately rapid; in the mineral soil above the permafrost—moderate; in the permafrost—impermeable
Available water capacity: including organic mat—low
Root restricting feature: permafrost
Depth to permafrost: 14 to 30 inches (36 to 76 cm) below the surface of the mineral soil
Depth to contrasting clayey material: 1 to 7 inches (3 to 18 cm)
Runoff: slow
Depth to perched water table: 12 to 24 inches (30 to 61 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Characteristics of Tolsona Soil

Positions on landscape: till plains
Slope range: 0 to 2 percent
Slope features: plane or concave
Organic mat on surface: 8 to 13 inches (20 to 33 cm) thick
Native vegetation: black and white spruce, low and dwarf shrubs, herbs, and moss

Typical profile:
*****9 inches to 0 (23 cm to 0)—very dark brown peat consisting of fibrous and partially decomposed roots, moss, and twigs
*****0 to 2 inches (0 to 5 cm)—very dark brown mucky silt loam
*****2 to 18 inches (5 to 46 cm)—olive gray gravelly loam
*****18 to 28 inches (46 to 71 cm)—perennially frozen, dark grayish brown gravelly loam

Drainage class: very poorly drained or poorly drained
Permeability: in the organic mat—moderately rapid; in the mineral soil—moderate; in the permafrost—impermeable
Available water capacity: including organic mat—moderate
Root restricting feature: permafrost
Depth to permafrost: 14 to 26 inches (36 to 66 cm) below the surface of the mineral soil
Depth to contrasting loamy till material: 1 to 8 inches (2 to 20 cm)
Runoff: slow
Depth to perched water table: 12 to 24 inches (30 to 61 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in similar positions that lack thick organic mats, permafrost, and the associated perched water table within 40 inches (100 cm)
*****soils in muskegs that have over 16 inches (40 cm) of organic material overlying mineral soil
*****soils in similar positions with sandy or very gravelly textures within 40 inches (100 cm) of the mineral surface
*****soils with slopes greater than 2 percent

Major Uses

Current uses: wildlife habitat
Potential uses: homesteads, hayland and pastureland, and forestland

Major Management Factors

Soil-related factors: wind erosion, available water capacity, depth to permafrost, frost heaving, load supporting capacity, restricted permeability, thermokarst, low fertility, and depth to perched water table
Elevation: 1400 to 2000 feet (427 to 610 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—60 to 80 days (28 degree base temperature)

Hayland and Pastureland

Klawasi and Tolsona soils with permafrost:
General management considerations:

*Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost and subsequent lowering of the water table.
*Differential subsidence may occur where massive ice features are present.

Suitable management practices:
*Leave strips of trees as windbreaks when clearing.

Klawasi and Tolsona soils when thawed:
General management considerations:
*Due to frequent mid-summer frosts and a relatively short frost-free season, the suitable crops for planting are hay, permanent pasture, and grain crops harvested as hay.
*Small depressional areas that comprise up to 10 percent of this unit remain wet for extended periods in the spring and may delay cultivation.
*Additional drainage may be necessary in areas where natural drainage outlets are absent.
*Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.
*Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*Hay crops respond well to fertilizer if precipitation is adequate.
*Occasional boulders on the surface may present a hazard to machinery.
*The high content of strongly granulated clay in Klawasi soils reduces the amount of moisture available to plants.

Suitable management practices:
*Use conservation tillage to conserve moisture and maintain or improve soil fertility.
*Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*Conduct on-site investigations to determine if massive ice features are present.

Forestland

Klawasi soil with permafrost:
Principal tree species are: dwarf black spruce and white spruce
Common understory plants are: Labrador tea ledum, red bearberry, lowbush cranberry, bog blueberry, and moss
Mean site index and yields: not estimated—the presence of permafrost and the associated perched water table result in stunted growth and low site productivity

General management considerations:
*Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost, lowering of the water table, and increased site productivity.

Klawasi soil when thawed:
Principal tree species are: white spruce and quaking aspen
Common understory plants are: soapberry, tall willow, red bearberry, Labrador tea ledum, pumpkinberry, and moss.
Estimated site index (100 year site curve) for stated species: white spruce—72
Estimated total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—1100 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2600 cubic feet/acre *(Farr 1967)*

General management considerations:
*Productivity of maturing stands may decline significantly as permafrost and the associated perched water table rise within the soil profile.
*Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*Logging roads may require ballast.
*Adequately designed drainage systems reduce the risk of concentrated flow erosion on roadways.
*The soil has low bearing capacity and is poor roadbuilding material.
*Because cold soil temperatures restrict roots, trees are subject to windthrow.
*Tree seedlings have a moderate rate of survival because of the silty clay and clay textures within a 10 inch depth.
*Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked stand of trees.
*Trees suitable for planting are white spruce.
Suitable management practices:
*Use conventional equipment in harvesting, but limit its use when the soil is wet.
*Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Tolsona soil with permafrost:
Principal tree species are: dwarf black spruce and white spruce

Common understory plants are: Labrador tea ledum, lowbush cranberry, black crowberry, bog blueberry, and moss
Mean site index and yields: not estimated—the presence of permafrost and the associated perched water table result in stunted growth and low site productivity

General management considerations:
*****Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost, lowering of the water table, and increased site productivity.

Tolsona soil when thawed:
Principal tree species are: white spruce and quaking aspen
Common understory plants are: soapberry, tall willow, red bearberry, Labrador tea ledum, lowbush cranberry, pumpkinberry, and moss
Estimated site index (100 year site curve) for stated species: white spruce—65
Estimated total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—600 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2100 cubic feet/acre *(Farr 1967)*

General management considerations:
*****Productivity of maturing stands may decline significantly as permafrost and the associated perched water table rise within the soil profile.
*****Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*****Logging roads may require ballast.
*****Because cold soil temperatures restrict roots, trees are subject to windthrow.
*****Tree seedlings have a moderate rate of survival because of cold soil temperatures.
*****Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked stand of trees.
*****Trees suitable for planting are white spruce.

Suitable management practices:
*****Use conventional equipment in harvesting, but limit its use when the soil is wet.
*****Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*****Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

Klawasi soil with permafrost:
General management considerations:
*****Excavation is hampered by permafrost.
*****Excavation can expose material that is highly susceptible to wind erosion.
*****Frost action limits construction of access roads, driveways, and buildings.
*****Local roads may require a special base to prevent permafrost damage.
*****Septic tank absorption fields may function poorly because of wetness and the limited depth to permafrost, which restrict the movement and infiltration of effluent.

Suitable management practices:
*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*****Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.
*****Construct buildings on thick gravel pads to reduce subsidence caused by the melting of permafrost.
*****Leave the vegetation and organic mat intact where it is desirable to maintain the present level of permafrost.
*****Clearing large areas with obvious surface drainage outlets results in the eventual subsidence of the permafrost and water table to below 60 inches (152 cm).

Klawasi soil when thawed:
General management considerations:
*****Excavation can expose material that is highly susceptible to wind erosion.
*****Frost action limits construction of access roads, driveways, and buildings.
*****Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.
*****Depressional areas that comprise up to 10 percent of this unit remain wet after clearing.
*****Septic tank absorption fields may function poorly because of degraded soil structure and reduced permeability upon addition of effluent.

Suitable management practices:
*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*****Provide drainage to reduce wetness if roads and buildings are to be constructed in depressional areas.

*Consider the depth to which annual frosts penetrate when designing footings and road bases.
*Increase the size of septic absorption areas to compensate for the restricted permeability.
*Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Conduct on-site investigations to determine if massive ice features are present.
*Underlay roads with gravel to minimize frost action.

Tolsona soil with permafrost:
General management considerations:
*Excavation is hampered by permafrost.
*Excavation can expose material that is highly susceptible to wind erosion.
*Frost action limits construction of access roads, driveways, and buildings.
*Local roads may require a special base to prevent permafrost damage.
*Septic tank absorption fields may function poorly because of wetness and the limited depth to permafrost, which restrict the movement and infiltration of effluent.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.
*Construct buildings on thick gravel pads to reduce subsidence caused by the melting of permafrost.
*Underlay roads with gravel to minimize frost action.
*Leave the vegetation and organic mat intact where it is desirable to maintain the present level of permafrost.
*Clearing large areas with obvious surface drainage outlets results in the eventual subsidence of the permafrost and water table to below 60 inches (152 cm).

Tolsona soil when thawed:
General management considerations:
*Excavation can expose material that is highly susceptible to wind erosion.
*Frost action limits construction of access roads, driveways, and buildings.
*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.
*Depressional areas that comprise up to 10 percent of this unit remain wet after clearing.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Provide drainage to reduce wetness if roads and buildings are to be constructed in depressional areas.
*Consider the depth to which annual frosts penetrate when designing footings and road bases.
*Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Conduct on-site investigations to determine if massive ice features are present.
*Underlay roads with gravel to minimize frost action.

446—Gakona-Stuck complex, 0 to 2 percent slopes

Composition

Gakona silt loam and similar inclusions: 55 percent
Stuck silt loam and similar inclusions: 30 percent
Contrasting inclusions: 15 percent

Characteristics of Gakona Soil

Positions on landscape: broad lacustrine terraces
Slope range: 0 to 2 percent
Slope features: plane
Organic mat on surface: 1 to 5 inches (2 to 12 cm) thick
Native vegetation: white spruce, aspen, tall willow, low and dwarf shrubs, and herbs

Typical profile:
*0 to 2 inches (0 to 5 cm)—very dark grayish brown and dark grayish brown silt loam
*2 to 60 inches (5 to 152 cm)—dark grayish brown and olive gray silty clay

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: low
Depth to contrasting clayey material: 1 to 8 inches (2 to 20 cm)
Runoff: slow
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Characteristics of Stuck Soil

Positions on landscape: broad lacustrine terraces
Microtopography: drainages and depressions
Slope range: 0 to 2 percent

Slope features: plane or concave
Organic mat on surface: 2 to 6 inches (5 to 15 cm) thick
Native vegetation: white spruce, tall willow, low and dwarf shrubs, herbs, and moss

Typical profile:
*0 to 2 inches (0 to 5 cm)— very dark brown silt loam
*2 to 22 inches (5 to 56 cm)—very dark brown sand
*22 to 60 inches (56 to 152 cm)—dark grayish brown clay

Drainage class: somewhat poorly drained
Permeability: in the silty surface—moderate; in the sandy material—rapid; in the clayey substratum—moderately slow
Available water capacity: low
Depth to contrasting sandy material: 1 to 5 inches (2 to 15 cm)
Depth to contrasting clayey material: 16 to 37 inches (41 to 94 cm)
Runoff: slow
Depth to water table: 32 to 45 inches (81 to 114 cm)
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in similar positions with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*soils in similar positions that have very gravelly material within 40 inches (100 cm)
*soils in muskegs that are very poorly drained and have over 16 inches (40 cm) of organic materials over mineral soil and permafrost
*soils along streams that are flooded
*soils that have slopes of more than 2 percent

Major Uses

Current uses: homesteads, low density housing, cropland, and hayland and pastureland
Potential uses: forestland

Major Management Factors

Soil-related factors: wind erosion, available water capacity, depth to water table, frost heaving, load supporting capacity, restricted permeability, and low fertility
Elevation: 1100 to 1600 feet (335 to 488 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*frost-free period—70 to 90 days (28 degree base temperature)

Cropland

General management considerations:
*Suitable crops for planting are climatically adapted vegetables, short season grain varieties, potatoes, and hay.
*Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*Crops respond well to fertilizer if precipitation is adequate.
*The high content of strongly granulated clay in Gakona soils and sand in Stuck soils reduces the amount of moisture available to plants.
*Occasional boulders and cobbles may present a hazard to machinery.
*Small depressional areas that comprise up to 10 percent of this unit remain wet for extended periods in the spring and may delay cultivation.
*Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.

Suitable management practices:
*Use conservation tillage to conserve moisture.
*Rotate crops and use conservation tillage to maintain or improve soil fertility.
*Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*Leave strips of trees as windbreaks when clearing.
*Conduct on-site investigations to determine if deep massive ice features are present.

Forestland

Gakona soil:
Principal tree species are: white spruce and quaking aspen
Common understory plants are: tall willow, red bearberry, pumpkinberry, lowbush cranberry, and moss
Mean site index (100 year site curve) for stated species (and source): white spruce—72 *(Farr 1967),* based on a sample of 26 trees in 5 plots
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at

breast height—1100 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2600 cubic feet/acre *(Farr 1967)*

General management considerations:

*Productivity of maturing stands may decline significantly as permafrost and the associated perched water table rise within the soil profile.

*Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.

*Logging roads may require ballast.

*The soil has low bearing capacity and is a poor source of roadbuilding material.

*Because cold soil temperatures restrict roots, trees are subject to windthrow.

*Tree seedlings have a moderate rate of survival because of silty clay and clay textures at depths less than 10 inches.

*Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.

*Trees suitable for planting are white spruce.

Suitable management practices:

*Use conventional equipment in harvesting, but limit its use when the soil is wet.

*Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.

*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Stuck soil:

General management considerations:

*Productivity of maturing stands may decline significantly as permafrost and the associated perched water table rise within the soil profile.

Building Site Development

Gakona soil:

General management considerations:

*Excavation can expose soil material that is highly susceptible to wind erosion.

*Frost action limits the construction of access roads, driveways, and buildings.

*Septic tank absorption fields may function poorly because of degraded soil structure and reduced permeability upon addition of effluent.

*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.

Suitable management practices:

*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.

*Increase the size of the septic absorption area to compensate for the restricted permeability.

*Stockpile topsoil and use it to reclaim areas disturbed during construction.

*Consider the depth to which annual frosts penetrate when designing footings and road bases.

*Conduct on-site investigations to determine if massive ice features are present.

*Underlay roads with gravel to minimize frost action.

Stuck soil:

General management considerations:

*Excavation can expose soil material that is highly susceptible to wind erosion.

*Frost action limits the construction of access roads, driveways, and buildings.

*Septic tank absorption fields may function poorly because of degraded soil structure and reduced permeability upon addition of effluent.

*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.

Suitable management practices:

*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.

*Provide drainage to reduce wetness if roads and building foundations are to be constructed.

*Increase the size of the septic absorption area to compensate for the restricted permeability.

*Stockpile topsoil and use it to reclaim areas disturbed during construction.

*Consider the depth to which annual frosts penetrate when designing footings and road bases.

*Conduct on-site investigations to determine if massive ice features are present.

*Underlay roads with gravel to minimize frost action.

447—Gakona-Chetaslina complex, 0 to 2 percent slopes

Composition

Gakona silt loam and similar inclusions: 45 percent
Chetaslina silt loam and similar inclusions: 40 percent
Contrasting inclusions: 15 percent

Characteristics of Gakona Soil

Positions on landscape: broad lacustrine terraces
Slope range: 0 to 2 percent
Slope features: plane
Organic mat on surface: 1 to 5 inches (2 to 12 cm) thick
Native vegetation: white spruce, aspen, tall willow, low and dwarf shrubs, and herbs

Typical profile:
*0 to 1 inch (0 to 2 cm)—dark brown silt loam
*1 to 60 inches (2 to 152 cm)—olive gray silty clay

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: low
Depth to contrasting clayey material: 1 to 8 inches (2 to 20 cm)
Runoff: slow
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Characteristics of Chetaslina Soil

Positions on landscape: broad lacustrine terraces
Slope range: 0 to 2 percent
Slope features: plane
Organic mat on surface: 2 to 5 inches (5 to 12 cm) thick
Native vegetation: aspen, white spruce, tall willow, low and dwarf shrubs, and herbs

Typical profile:
*0 to 7 inches (0 to 18 cm)—dark grayish brown and brown silt loam
*7 to 12 inches (18 to 30 cm)—dark grayish brown silty clay loam
*12 to 60 inches (30 to 152 cm)—dark grayish brown silty clay loam and gravelly loam

Drainage class: well drained
Permeability: moderate
Available water capacity: high
Depth to contrasting loamy lacustrine material: 4 to 13 inches (10 to 33 cm)
Runoff: slow
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in similar positions with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*soils in similar positions that have very gravelly, sandy, or cobbly material within 40 inches (100 cm)
*soils that have slopes of more than 2 percent

Major Uses

Current uses: wildlife habitat
Potential uses: homesteads, hayland and pastureland, and forestland

Major Management Factors

Soil-related factors: wind erosion, available water capacity, frost heaving, load supporting capacity, restricted permeability, and low fertility
Elevation: 1400 to 2000 feet (427 to 609 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*frost-free period—60 to 80 days (28 degree base temperature)

Hayland and Pastureland

General management considerations:
*Due to frequent mid-summer frosts and a relatively short frost-free season, suitable crops for planting are hay, permanent pasture, and grain crops harvested as hay.
*Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*Hay crops respond well to fertilizer if precipitation is adequate.
*The high content of strongly granulated clay in Gakona soil reduces the amount of moisture available to plants.
*Occasional boulders and cobbles may present a hazard to machinery.
*Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.

Suitable management practices:
*Use conservation tillage to conserve moisture and maintain or improve soil fertility.
*Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*Leave strips of trees as windbreaks when clearing.
*Conduct on-site investigations to determine if deep massive ice features are present.

Forestland

Gakona soil:
Principal tree species are: white spruce and quaking aspen

Common understory plants are: soapberry, tall willow, red bearberry, pumpkinberry, Labrador tea ledum, lowbush cranberry, and moss
Mean site index (100 year site curve) for stated species (and source): white spruce—72 *(Farr 1967),* based on a sample of 26 trees in 5 plots
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—1100 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2600 cubic feet/acre *(Farr 1967)*

General management considerations:
*****Productivity of maturing stands may decline significantly as permafrost and the associated perched water table rise within the soil profile.
*****Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*****Logging roads may require ballast.
*****The soil has low bearing capacity and is a poor source of roadbuilding material.
*****Because cold soil temperatures restrict roots, trees are subject to windthrow.
*****Tree seedlings have a moderate rate of survival because of silty clay and clay textures at a depth of less than 10 inches.
*****Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*****Trees suitable for planting are white spruce.

Suitable management practices:
*****Use conventional equipment in harvesting, but limit its use when the soil is wet.
*****Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*****Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Chetaslina soil:
Principal tree species are: white spruce and quaking aspen
Common understory plants are: soapberry, tall willow, red bearberry, black crowberry, pumpkinberry, Labrador tea ledum, lowbush cranberry, and moss
Estimated site index (100 year site curve) for stated species: white spruce—69
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 4.5 inches diameter at breast height—2390 cubic feet/acre; trees greater than 8.5 inches diameter at breast height—900 cubic feet/acre *(Farr 1967)*

General management considerations:
*****Productivity of maturing stands may decline significantly as permafrost and the associated perched water table rise within the soil profile.
*****Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*****Logging roads may require ballast.
*****The soil has low bearing capacity and is a poor source of roadbuilding material.
*****Because cold soil temperatures restrict roots, trees are subject to windthrow.
*****Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*****Trees suitable for planting are white spruce.

Suitable management practices:
*****Use conventional equipment in harvesting, but limit its use when the soil is wet.
*****Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*****Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

Gakona soil:
General management considerations:
*****Excavation can expose soil material that is highly susceptible to wind erosion.
*****Frost action limits the construction of access roads, driveways, and buildings.
*****Septic tank absorption fields may function poorly because of degraded soil structure and reduced permeability upon addition of effluent.
*****Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.

Suitable management practices:
*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*****Increase the size of the septic absorption area to compensate for the restricted permeability.
*****Stockpile topsoil and use it to reclaim areas disturbed during construction.
*****Consider the depth to which annual frosts penetrate when designing footings and road bases.
*****Conduct on-site investigations to determine if massive ice features are present.
*****Underlay roads with gravel to minimize frost action.

Chetaslina soil:
General management considerations:
*****Excavation can expose soil material that is highly susceptible to wind erosion.

*The quality of roadbeds and road surfaces is adversely affected by frost action and limited soil strength.
*Septic tank absorption fields may function poorly because of the restricted permeability of the soil.
*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Increase the size of the septic absorption area to compensate for the restricted permeability.
*Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Consider the depth to which annual frosts penetrate when designing footings and road bases.
*Conduct on-site investigations to determine if massive ice features are present.
*Underlay roads with gravel to minimize frost action.

448—Klawasi-Wrangell complex, 0 to 2 percent slopes

Composition

Klawasi peat and similar inclusions: 40 percent
Wrangell peat and similar inclusions: 30 percent
Klawasi peat, depressional, and similar inclusions: 25 percent
Contrasting inclusions: 5 percent

Characteristics of Klawasi Soil

Positions on landscape: broad lacustrine terraces
Slope range: 0 to 2 percent
Slope features: plane to convex
Organic mat on surface: 9 to 14 inches (23 to 36 cm) thick
Native vegetation: dwarf black and white spruce, low and dwarf shrubs, herbs, and moss

Typical profile:
*9 inches to 0 (25 cm to 0)—dark reddish brown peat and black mucky peat consisting of fibrous and partially decomposed roots, moss, and twigs
*0 to 1 inch (0 to 2 cm)—very dark gray mucky silt loam
*1 to 3 inches (2 to 8 cm)—dark brown silt loam
*3 to 19 inches (8 to 48 cm)—olive gray silty clay
*19 to 29 inches (48 to 74 cm)—perennially frozen, olive gray silty clay

Drainage class: very poorly drained or poorly drained
Permeability: in the organic mat—moderately rapid; in the mineral soil above the permafrost—moderate; in the permafrost—impermeable
Available water capacity: including organic mat—low
Root restricting feature: permafrost
Depth to permafrost: 14 to 30 inches (36 to 76 cm) below the surface of the mineral soil
Depth to contrasting clayey material: 1 to 7 inches (2 to 18 cm)
Runoff: very slow
Depth to perched water table: 9 to 20 inches (23 to 50 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Characteristics of Wrangell Soil

Positions on landscape: broad lacustrine terraces
Slope range: 0 to 2 percent
Slope features: plane to convex
Organic mat on surface: 18 to 33 inches (46 to 84 cm) thick
Native vegetation: low ericaceous shrubs and willows, sedges, moss, and stunted black spruce

Typical profile:
*0 to 4 inches (0 to 10 cm)—dark reddish brown peat consisting of undecomposed roots, sedges, and shrub fibers
*4 to 23 inches (10 to 58 cm)—dark reddish brown mucky peat consisting of decomposed root, sedge, and shrub fibers
*23 to 37 inches (58 to 94 cm)—dark greenish gray and olive gray silty clay
*37 to 47 inches (94 to 119 cm)—perennially frozen, olive gray silty clay

Drainage class: very poorly drained
Permeability: in the organic layers—moderately rapid; in the mineral soil—slow; in the permafrost—impermeable
Available water capacity: very high
Root restricting feature: permafrost
Depth to permafrost: 14 to 38 inches (36 to 97 cm) below the surface of the mineral soil
Runoff: slow
Depth to perched water table: 0 to 8 inches (0 to 20 cm) below the surface of the organic mat
Hazard of erosion: by water—slight; by wind—slight
Hazard of flooding: none

Characteristics of Klawasi, Depressional Soil

Positions on landscape: broad lacustrine terraces
Microtopography: depressions
Slope range: 0 to 2 percent
Slope features: concave
Organic mat on surface: 10 to 14 inches (25 to 36 cm) thick
Native vegetation: dwarf black spruce, low and dwarf ericaceous shrubs and willows, sedges, grasses, and moss

Typical profile:
*****12 inches to 0 (30 cm to 0)—dark brown peat and black mucky peat consisting of fibrous and partially decomposed roots, moss, and twigs
*****0 to 1 inch (0 to 2 cm)—very dark brown mucky silt loam
*****1 to 17 inches (2 to 43 cm)—olive gray silty clay
*****17 to 27 inches (43 to 69 cm)—perennially frozen, olive gray silty clay

Drainage class: very poorly drained
Permeability: in the organic mat—moderately rapid; in the mineral soil above the permafrost—moderate; in the permafrost—impermeable
Available water capacity: including organic mat—low
Root restricting feature: permafrost
Depth to permafrost: 14 to 30 inches (36 to 76 cm) below the surface of the mineral soil
Depth to contrasting clayey material: 1 to 7 inches (3 to 18 cm)
Runoff: very slow
Depth to perched water table: 0 to 8 inches (0 to 200 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in convex positions that lack permafrost and the associated perched water table in the surface 40 inches (100 cm)
*****soils in similar positions that have over 60 inches (152 cm) of organic material overlying mineral soil
*****water
*****soils with slopes greater than 2 percent

Major Uses

Current uses: wildlife habitat

Major Management Factors

Soil-related factors: depth to water table
Elevation: 1200 to 1800 feet (360 to 540 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—60 to 90 days (28 degree base temperature)

449—Klutina-Klutina, rarely flooded, complex, 0 to 2 percent slopes

Composition

Klutina very fine sandy loam and similar inclusions: 60 percent
Klutina, silt loam, rarely flooded, and similar inclusions: 25 percent
Contrasting inclusions: 15 percent

Characteristics of Klutina Soil

Positions on landscape: floodplains and low stream terraces
Slope range: 0 to 2 percent
Slope features: plane
Organic mat on surface: 1 to 5 inches (2 to 12 cm) thick
Native vegetation: tall alder and willow, scattered low shrubs and herbs, and occasional balsam poplar

Typical profile:
*****0 to 3 inches (0 to 8 cm)—very dark grayish brown very fine sandy loam
*****3 to 25 inches (8 to 64 cm)—stratified dark grayish brown and very dark grayish brown silt loam, very fine sandy loam, fine sandy loam, loamy fine sand, and sand.
*****25 to 60 inches (64 to 152 cm)—stratified very dark grayish brown very gravelly sand, very fine sand, fine sand, and loamy fine sand.

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: in the loamy surface layers—moderate; in the sand and gravel substratum—rapid
Available water capacity: low
Depth to contrasting gravelly material: 12 to 29 inches (30 to 74 cm)
Runoff: slow

Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: occasional—in addition to the spring and summer flooding hazard, intense channel freezing results in a winter flooding hazard

Characteristics of Klutina, Rarely Flooded Soil

Positions on landscape: stream terraces
Slope range: 0 to 2 percent
Slope features: plane
Organic mat on surface: 1 to 5 inches (2 to 12 cm) thick
Native vegetation: white spruce, balsam polar, scattered low shrubs, and herbs

Typical profile:
*****0 to 3 inches (0 to 8 cm)—dark yellowish brown and very dark brown silt loam
*****3 to 13 inches (8 to 33 cm)—dark gray stratified sand and silt loam
*****13 to 60 inches (33 to 152 cm)—dark gray extremely gravelly sand

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: in the loamy surface layers—moderate; in the sand and gravel substratum—rapid
Available water capacity: low
Depth to contrasting gravelly material: 12 to 29 inches (30 to 74 cm)
Runoff: slow
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: rare

Included Areas

*****soils on stream terraces that have thick organic horizons, permafrost, and a perched water table within 40 inches (100 cm)
*****soils in similar positions that are gravelly and cobbly throughout the profile.
*****soils on narrow, steep escarpments
*****riverwash and intermingling river channels
*****soils that have slopes of more than 2 percent

Major Uses

Current uses: homesteads, low density housing, and gravel source
Potential uses: cropland, hayland and pastureland, and forestland

Major Management Factors

Soil-related factors: wind erosion, available water capacity, rapid permeability, and flooding
Elevation: 600 to 1300 feet (183 to 396 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—70 to 90 days (28 degree base temperature)

Cropland

General management considerations:
*****Occasional flooding limits the production and harvesting of crops.
*****Most climatically adapted crops can be grown if adequate protection from flooding is provided.
*****Suitable crops for planting are climatically adapted vegetables, short season grain varieties, potatoes, and hay.
*****Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*****Crops respond well to fertilizer if precipitation is adequate.
*****Occasional boulders and cobbles may present a hazard to machinery.
*****The high content of sand in the surface horizons reduces the amount of moisture available to plants.
*****Narrow, steep escarpments may limit the size of continuous tillable units.

Suitable management practices:
*****Construct grass waterways in cultivated areas that are subject to overflow.
*****Use conservation tillage to conserve moisture.
*****Use shallow cuts when land smoothing to avoid exposing gravelly material.
*****Rotate crops and use conservation tillage to maintain or improve soil fertility.
*****Maintain crop residue on the surface, plant crops in narrow strips at right angles to prevailing wind, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*****Leave strips of trees as windbreaks when clearing.

Forestland

Klutina soil:
General management considerations:
*****Occasional flooding has prevented the establishment

of trees on this soil.

Klutina, rarely flooded soil:
Principal tree species are: white spruce and balsam poplar
Common understory plants are: twinflower, lupine, pumpkinberry, moss, prickly rose, highbush cranberry, and soapberry
Mean site index (100 year site curve) for stated species (and source): white spruce—70 *(Farr 1967),* based on a sample of 37 trees in 7 plots
Estimated average total production for stated species (and source) at age 100 years: white spruce trees greater than 8.5 inches diameter at breast height—950 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2450 cubic feet/acre *(Farr 1967)*

General management considerations:
*****The upper part of the profile is loose when dry, which hinders the use of wheeled and tracked equipment.
*****Constructing roads across narrow, steep escarpment slopes results in large cuts and fills which increase the risk of erosion and take a greater amount of land out of production.
*****Mortality of seedlings may be high in areas that are subject to flooding.
*****Because gravelly material and cold soil temperatures restrict roots, trees are highly subject to windthrow.
*****Trees suitable for planting are white spruce.

Suitable management practices:
*****Use conventional equipment in harvesting.
*****Seed cuts and fills and stabilize cuts with grass straw mulch to reduce the risk of erosion.
*****Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

Klutina soil:
General management considerations:
*****This soil has severe limitations for homesteads and urban development due to the occasional flooding hazard.
*****This soil is a good source of gravel.

Klutina, rarely flooded soil:
General management considerations:
*****This soil has severe limitations for homesteads and urban development due to the rare flooding hazard.
*****Excavation can expose soil material that is highly susceptible to wind erosion.
*****Streambank erosion presents a hazard to structures.
*****Cutbanks are not stable and are subject to caving.
*****This unit is a fair source of roadfill and a good source of gravel.
*****Septic tank absorption fields may function poorly because of wetness during periods of flooding.
*****The rapid permeability of the substratum may allow effluent from moderate or high density housing to pollute the ground water.

Suitable management practices:
*****Locate structures above the expected flood level, provide interceptor ditches, and establish adequate outlets and drainageways to reduce the risk of flooding.
*****Protect on-site sewage disposal systems from flooding.
*****Establish gently sloping grades on roadcuts and excavations to reduce the risk of caving.
*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.

450—Klutina silt loam, rarely flooded, 2 to 7 percent slopes

Composition

Klutina silt loam and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Klutina Soil

Positions on landscape: stream terraces
Slope range: 2 to 7 percent
Slope features: plane
Organic mat on surface: 1 to 5 inches (2 to 12 cm) thick
Native vegetation: white spruce, balsam poplar, scattered low shrubs, and herbs

Typical profile:
*****0 to 2 inches (0 to 5 cm)—very dark brown silt loam
*****2 to 13 inches (5 to 33 cm)—dark gray stratified sand and silt loam
*****13 to 60 inches (33 to 152 cm)—dark gray very gravelly sand

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: in the loamy surface layers—moderate; in the sand and gravel substratum—rapid
Available water capacity: low
Depth to contrasting gravelly material: 12 to 29 inches (30 to 74 cm)
Runoff: medium
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is

removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: rare

Included Areas

*soils in similar positions that have thick organic horizons, permafrost, and a perched water table within 40 inches (100 cm)
*soils in similar positions that are sandy or gravelly and cobbly throughout the profile.
*soils on narrow, steep escarpments
*soils that have slopes of less than 2 percent or more than 7 percent

Major Uses

Current uses: wildlife habitat, low density housing, and gravel source
Potential uses: cropland, hayland and pastureland, and forestland

Major Management Factors

Soil-related factors: wind erosion, water erosion, available water capacity, rapid permeability, and flooding
Elevation: 600 to 1300 feet (183 to 396 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*frost-free period—70 to 90 days (28 degree base temperature)

Cropland

General management considerations:
*Suitable crops for planting are climatically adapted vegetables, short season grain varieties, potatoes, and hay.
*Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*Crops respond well to fertilizer if precipitation is adequate.
*Occasional cobbles on the surface may present a hazard to machinery.
*The high content of sand in the surface horizons reduces the amount of moisture available to plants.
*Narrow, steep escarpments may limit the size of continuous tillable units.

Suitable management practices:
*Use conservation tillage to conserve moisture.
*Rotate crops and use conservation tillage to maintain or improve soil fertility.
*Use shallow cuts when land smoothing to avoid exposing gravelly material.
*Plant crops in narrow strips at right angles to prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*Cultivate and seed on the contour or across the slope and maintain crop residue on or near the surface to reduce the risk of water erosion.
*Grow row crops in rotation with hay and grain to reduce the hazard of water erosion.
*Leave strips of trees as windbreaks when clearing.

Forestland

Principal tree species are: white spruce and balsam poplar
Common understory plants are: twinflower, lupine, pumpkinberry, moss, prickly rose, highbush cranberry, and soapberry
Mean site index (100 year site curve) for stated species (and source): white spruce—70 *(Farr 1967),* based on a sample of 37 trees in 7 plots
Estimated average total production for stated species (and source) at age 100 years: white spruce trees greater than 8.5 inches diameter at breast height—950 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2450 cubic feet/acre *(Farr 1967)*

General management considerations:
*The upper part of the profile is loose when dry, which hinders the use of wheeled and tracked equipment.
*Constructing roads across narrow, steep escarpment slopes results in large cuts and fills which increase the risk of erosion and take a greater amount of land out of production.
*Because gravelly material and cold soil temperatures restrict roots, trees are highly subject to windthrow.
*Mortality of seedlings may be high in areas that are subject to flooding.
*Trees suitable for planting are white spruce.

Suitable management practices:
*Use conventional equipment in harvesting.
*Seed cuts and fills to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

General management considerations:
*This soil has severe limitations for homesteads and urban development due to the rare flooding hazard.
*Excavation can expose soil material that is highly

susceptible to wind erosion.
*Excavation increases the risk of water erosion.
*Streambank erosion presents a hazard to structures.
*Cutbanks are not stable and are subject to caving.
*This unit is a fair source of roadfill and a good source of gravel.
*Septic tank absorption fields may function poorly because of wetness during periods of flooding.
*The rapid permeability of the substratum may allow effluent from moderate or high density housing to pollute the ground water.

Suitable management practices:
*Locate structures above the expected flood level, provide interceptor ditches, and establish adequate outlets and drainageways to reduce the risk of flooding.
*Protect on-site sewage disposal systems from flooding.
*Establish gently sloping grades on roadcuts and excavations to reduce the risk of caving.
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.

451—Klutina-Nizina complex, 0 to 2 percent slopes

Composition

Klutina very fine sandy loam and similar inclusions: 35 percent
Nizina loamy fine sand and similar inclusions: 35 percent
Klutina, silt loam, rarely flooded, and similar inclusions: 20 percent
Contrasting inclusions: 10 percent

Characteristics of Klutina Soil

Positions on landscape: floodplains and low stream terraces
Slope range: 0 to 2 percent
Slope features: plane
Organic mat on surface: 1 to 5 inches (2 to 12 cm) thick
Native vegetation: tall alder and willow, scattered low shrubs and herbs, and occasional balsam poplar

Typical profile:
*0 to 3 inches (0 to 8 cm)—very dark grayish brown very fine sandy loam
*3 to 25 inches (8 to 64 cm)—stratified dark grayish brown and very dark grayish brown silt loam, very fine sandy loam, fine sandy loam, loamy fine sand, and sand.
*25 to 60 inches (64 to 152 cm)—stratified very dark grayish brown very gravelly sand, very fine sand, fine sand, and loamy fine sand.

Depth class: very deep (more than 60 inches, or 152 cm)

Drainage class: well drained
Permeability: in the loamy surface layers—moderate; in the sand and gravel substratum—rapid
Available water capacity: low
Depth to contrasting gravelly material: 12 to 29 inches (30 to 74 cm)
Runoff: slow
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: occasional—in addition to the spring and summer flooding hazard, intense channel freezing results in a winter flooding hazard

Characteristics of Nizina Soil

Positions on landscape: floodplains
Slope range: 0 to 2 percent
Slope features: plane—with many short, steep escarpments and incisions
Organic mat on surface: 0 to 3 inches (0 to 8 cm) thick
Native vegetation: tall alder and willow, scattered low shrubs and herbs, and occasional balsam poplar
Surface rock fragments: 0 to 15 percent gravel and cobble

Typical profile:
*0 to 4 inches (0 to 10 cm)—very dark grayish brown loamy fine sand
*4 to 60 inches (10 to 152 cm)—dark olive gray extremely cobbly sand

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: in the loamy surface layers—moderately rapid; in the sand and gravel substratum—rapid
Available water capacity: low
Depth to contrasting gravelly and cobbly material: 2 to 8 inches (5 to 10 cm)
Runoff: slow
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: occasional—in addition to the spring and summer flooding hazard, intense channel freezing results in a winter flooding hazard

Characteristics of Klutina, Rarely Flooded Soil

Positions on landscape: stream terraces
Slope range: 0 to 2 percent

Slope features: plane
Organic mat on surface: 1 to 5 inches (2 to 12 cm) thick
Native vegetation: white spruce, balsam polar, scattered low shrubs, and herbs

Typical profile:
*****0 to 2 inches (0 to 5 cm)—very dark brown silt loam
*****2 to 13 inches (5 to 33 cm)—dark gray stratified sand and silt loam
*****13 to 60 inches (33 to 152 cm)—dark gray very gravelly sand

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: in the loamy surface layers—moderate; in the sand and gravel substratum—rapid
Available water capacity: low
Depth to contrasting gravelly and cobbly material: 12 to 29 inches (30 to 74 cm)
Runoff: slow
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: rare

Included Areas

*****soils in similar positions that are very gravelly in the surface layers
*****soils on narrow, steep escarpments
*****riverwash and intermingling river channels
*****soils in similar positions that are sandy throughout the profile or are poorly drained

Major Uses

Current uses: homesteads, low density housing, and gravel source
Potential uses: forestland

Major Management Factors

Soil-related factors: wind erosion, rapid permeability, and flooding
Elevation: 600 to 1300 feet (183 to 396 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—70 to 90 days (28 degree base temperature)

Forestland

Klutina and Nizina soils:
General management considerations:
*****Occasional flooding has prevented the establishment of trees on these soils.

Klutina, rarely flooded soil:
Principal tree species are: white spruce and balsam poplar
Common understory plants are: twinflower, lupine, pumpkinberry, moss, prickly rose, highbush cranberry, and soapberry
Mean site index (100 year site curve) for stated species (and source): white spruce—70 *(Farr 1967),* based on a sample of 37 trees in 7 plots
Estimated average total production for stated species (and source) at age 100 years: white spruce trees greater than 8.5 inches diameter at breast height—950 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2450 cubic feet/acre *(Farr 1967)*

General management considerations:
*****Adequately designed drainage systems reduce the risk of concentrated flow erosion on roadways.
*****Constructing roads across narrow, steep escarpment slopes results in large cuts and fills which increase the risk of erosion and take a greater amount of land out of production.
*****Mortality of seedlings may be high in areas that are subject to flooding.
*****Because gravelly material and cold soil temperatures restrict roots, trees are highly subject to windthrow.
*****Trees suitable for planting are white spruce.

Suitable management practices:
*****Use conventional equipment in harvesting.
*****Seed cuts and fills to reduce the risk of erosion.
*****Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

Klutina and Nizina soils:
General management considerations:
*****These soils have severe limitations for homesteads and urban development due to the occasional flooding hazard.
*****These soils are a good source of gravel.

Klutina, rarely flooded soil:

General management considerations:

*This soil has severe limitations for homesteads and urban development due to the rare flooding hazard.

*Excavation can expose soil material that is highly susceptible to wind erosion.
*Streambank erosion presents a hazard to structures.
*Cutbanks are not stable and are subject to caving.
*This unit is a fair source of roadfill and a good source of gravel.
*Septic tank absorption fields may function poorly because of wetness during periods of flooding.
*The rapid permeability of the substratum may allow effluent from moderate or high density housing to pollute the ground water.

Suitable management practices:

*Locate structures above the expected flood level, provide interceptor ditches, and establish adequate outlets and drainageways to reduce the risk of flooding.
*Protect on-site sewage disposal systems from flooding.
*Establish gently sloping grades on roadcuts and excavations to reduce the risk of caving.
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.

452—Kuslina peat, 0 to 2 percent slopes

Composition

Kuslina peat and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Kuslina Soil

Positions on landscape: stream terraces
Slope range: 0 to 2 percent
Slope features: plane
Organic mat on surface: 8 to 16 inches (20 to 40 cm) thick
Native vegetation: black and white spruce, low and dwarf shrubs, herbs, and moss

Typical profile:

*10 inches to 0 (25 cm to 0)—dark brown peat and very dark brown mucky peat consisting of fibrous and partially decomposed roots, moss, and twigs
*0 to 4 inches (0 to 10 cm)—very dark brown silt loam with lenses of black mucky silt loam
*4 to 11 inches (10 to 28 cm)—very dark grayish brown fine sandy loam with thin strata of loamy fine sand and sand.
*11 to 21 inches (28 to 53 cm)—perennially frozen, very dark grayish brown fine sandy loam with thin strata of loamy sand, fine sand, and sand.

Drainage class: very poorly drained or poorly drained
Permeability: in the organic mat—moderately rapid; in the mineral soil above the permafrost—moderate over moderately rapid; in the permafrost—impermeable
Available water capacity: including organic mat—low
Root restricting feature: permafrost
Depth to permafrost: 12 to 18 inches (30 to 46 cm) below the surface of the mineral soil
Runoff: slow
Depth to perched water table: 12 to 18 inches (30 to 46 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in similar positions that lack thick organic mats, permafrost, and the associated perched water table within 40 inches (100 cm)
*soils in muskegs that have over 16 inches (40 cm) of organic material overlying mineral soil
*soils in similar positions with sandy or very gravelly surface textures
*soils on narrow, steep escarpments
*soils with slopes greater than 2 percent

Major Uses

Current uses: homesteads and wildlife habitat
Potential uses: cropland and hayland and pastureland

Major Management Factors

Soil-related factors: wind erosion, available water capacity, depth to permafrost, frost heaving, restricted permeability, thermokarst, depth to perched water table, and low fertility
Elevation: 600 to 1500 feet (183 to 457 m)

Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*frost-free period—70 to 90 days (28 degree base temperature)

Cropland

With permafrost:

General management considerations:

*****Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost and subsequent lowering of the water table.

*****Differential subsidence may occur where massive ice features are present.

Suitable management practices:

*****Leave strips of trees as windbreaks when clearing.

*****Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.

When thawed:

General management considerations:

*****Suitable crops for planting include climatically adapted vegetables, short season grain varieties, potatoes, and hay.

*****Additional drainage may be necessary in areas where natural drainage outlets are absent.

*****Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.

*****Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.

*****Crops respond well to fertilizer if precipitation is adequate.

*****Occasional boulders on the surface may present a hazard to machinery.

*****The high content of sand reduces the amount of moisture available to plants.

*****Narrow, steep escarpments may limit the size of continuous tillable units.

Suitable management practices:

*****Use conservation tillage to conserve moisture.

*****Rotate crops and use conservation tillage to maintain or improve soil fertility.

*****Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.

*****Use shallow cuts when land smoothing to avoid exposing gravelly and cobbly materials.

*****Conduct on-site investigations to determine if massive ice features are present.

Building Site Development

With permafrost:

General management considerations:

*****Excavation is hampered by permafrost.

*****Excavation can expose material that is highly susceptible to wind erosion.

*****Frost action limits construction of access roads, driveways, and buildings.

*****Cutbanks are not stable and are subject to caving.

*****Local roads may require a special base to prevent permafrost damage.

*****Septic tank absorption fields may function poorly because of wetness and the limited depth to permafrost, which restrict the movement and infiltration of effluent.

*****Differential subsidence may occur in areas where massive ice features are present.

Suitable management practices:

*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.

*****Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.

*****Construct buildings on thick gravel pads to reduce subsidence caused by the melting of permafrost.

*****Leave the vegetation and organic mat intact where it is desirable to maintain the present level of permafrost.

*****Underlay roads with gravel to minimize frost action.

*****Establish gently sloping grades to reduce the risk of caving.

*****Clearing large areas with obvious surface drainage outlets results in the eventual subsidence of the permafrost and water table to below 60 inches (152 cm).

When thawed:

General management considerations:

*****Excavation can expose material that is highly susceptible to wind erosion.

*****Frost action limits construction of access roads, driveways, and buildings.

*****Cutbanks are not stable and are subject to caving.

*****Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.

*****Depressional areas that comprise up to 10 percent of this unit remain wet after clearing.

Suitable management practices:

*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.

*****Provide drainage to reduce wetness if roads and buildings are to be constructed in depressional areas.

*****Consider the depth to which annual frosts penetrate when designing footings and road bases.

*****Establish gently sloping grades to reduce the risk of caving.

*Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Conduct on-site investigations to determine if massive ice features are present.
*Underlay roads with gravel to minimize frost action.

453—Kuslina peat, 2 to 7 percent slopes

Composition

Kuslina peat and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Kuslina Soil

Positions on landscape: stream terraces
Slope range: 2 to 7 percent
Slope features: plane
Organic mat on surface: 8 to 16 inches (20 to 40 cm) thick
Native vegetation: black and white spruce, low and dwarf shrubs, herbs, and moss

Typical profile:
*10 inches to 0 (25 cm to 0)—dark brown peat and very dark brown mucky peat consisting of fibrous and partially decomposed roots, moss, and twigs
*0 to 4 inches (0 to 10 cm)—very dark brown silt loam with lenses of black mucky silt loam
*4 to 11 inches (10 to 28 cm)—very dark grayish brown fine sandy loam with thin strata of loamy fine sand and sand.
*11 to 21 inches (28 to 53 cm)—perennially frozen, very dark grayish brown fine sandy loam with thin strata of loamy sand, fine sand, and sand.

Drainage class: very poorly drained or poorly drained
Permeability: in the organic mat—moderately rapid; in the mineral soil above the permafrost—moderate over moderately rapid; in the permafrost—impermeable
Available water capacity: including organic mat—low
Root restricting feature: permafrost
Depth to permafrost: 12 to 18 inches (30 to 46 cm) below the surface of the mineral soil
Runoff: slow
Depth to perched water table: 12 to 18 inches (30 to 46 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in similar positions that lack thick organic mats, permafrost, and the associated perched water table within 40 inches (100 cm)
*soils in muskegs that have over 16 inches (40 cm) of organic material overlying mineral soil
*soils in similar positions with sandy or very gravelly surface textures
*soils on narrow, steep escarpments
*soils with slopes less than 2 percent or greater than 7 percent

Major Uses

Current uses: homesteads and wildlife habitat
Potential uses: cropland and hayland and pastureland

Major Management Factors

Soil-related factors: wind erosion, water erosion, available water capacity, depth to permafrost, frost heaving, restricted permeability, thermokarst, depth to perched water table, and low fertility
Elevation: 600 to 1500 feet (183 to 457 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*frost-free period—70 to 90 days (28 degree base temperature)

Cropland

With permafrost:
General management considerations:
*Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost and subsequent lowering of the water table.
*Differential subsidence may occur where massive ice features are present.

Suitable management practices:
*Leave strips of trees as windbreaks when clearing.
*Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.

When thawed:
General management considerations:
*Suitable crops for planting include climatically adapted vegetables, short season grain varieties, potatoes, and hay.
*Additional drainage may be necessary in areas where natural drainage outlets are absent.

*Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.
*Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*Crops respond well to fertilizer if precipitation is adequate.
*Occasional cobbles on the surface may present a hazard to machinery.
*The high content of sand reduces the amount of moisture available to plants.
*Narrow, steep escarpments may limit the size of continuous tillable units.

Suitable management practices:
*Use conservation tillage to conserve moisture.
*Rotate crops and use conservation tillage to maintain or improve soil fertility.
*Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*Use shallow cuts when land smoothing to avoid exposing gravelly and cobbly materials.
*Prepare seedbeds on the contour or across the slope where practical.
*Grow row crops in rotation with hay and grain to reduce the hazard of water erosion.
*Cultivate and seed on the contour or across the slope and maintain crop residue on or near the surface to reduce the risk of water erosion.
*Conduct on-site investigations to determine if massive ice features are present.

Building Site Development

With permafrost:
General management considerations:
*Excavation is hampered by permafrost.
*Excavation can expose material that is highly susceptible to wind erosion.
*Excavation increases the risk of water erosion.
*Frost action limits construction of access roads, driveways, and buildings.
*Cutbanks are not stable and are subject to caving.
*Local roads may require a special base to prevent permafrost damage.
*Septic tank absorption fields may function poorly because of wetness and the limited depth to permafrost, which restrict the movement and infiltration of effluent.
*Differential subsidence may occur in areas where massive ice features are present.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.
*Construct buildings on thick gravel pads to reduce subsidence caused by the melting of permafrost.
*Leave the vegetation and organic mat intact where it is desirable to maintain the present level of permafrost.
*Underlay roads with gravel to minimize frost action.
*Establish gently sloping grades to reduce the risk of caving.
*Clearing large areas with obvious surface drainage outlets results in the eventual subsidence of the permafrost and water table to below 60 inches (152 cm).

When thawed:
General management considerations:
*Excavation can expose material that is highly susceptible to wind erosion.
*Frost action limits construction of access roads, driveways, and buildings.
*Cutbanks are not stable and are subject to caving.
*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Consider the depth to which annual frosts penetrate when designing footings and road bases.
*Establish gently sloping grades to reduce the risk of caving.
*Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Conduct on-site investigations to determine if massive ice features are present.
*Underlay roads with gravel to minimize frost action.

454—Mendeltna peat, 0 to 7 percent slopes

Composition

Mendeltna peat and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Mendeltna Soil

Positions on landscape: broad lacustrine terraces
Slope range: 0 to 7 percent

Slope features: plane
Organic mat on surface: 8 to 14 inches (20 to 36 cm) thick
Native vegetation: black and white spruce, low and dwarf shrubs, herbs, and moss

Typical profile:
*****9 inches to 0 (23 cm to 0)—dark reddish brown peat and black mucky peat consisting of fibrous and partially decomposed roots, moss, and twigs
*****0 to 2 inches (0 to 5 cm)—very dark grayish brown mucky silt loam
*****2 to 16 inches (5 to 41 cm)—olive gray gravelly clay loam
*****16 to 26 inches (41 to 66 cm)—perennially frozen, olive gray gravelly clay loam

Drainage class: very poorly drained or poorly drained
Permeability: in the organic mat—moderately rapid; in the mineral soil above the permafrost—moderate; in the permafrost—impermeable
Available water capacity: including organic mat—low
Root restricting feature: permafrost
Depth to permafrost: 14 to 29 inches (36 to 74 cm) below the surface of the mineral soil
Depth to contrasting loamy lacustrine material: 1 to 8 inches (2 to 20 cm) below the surface of the mineral soil
Runoff: slow
Depth to perched water table: 12 to 24 inches (30 to 61 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in similar positions that lack thick organic mats, permafrost, and the associated perched water table within 40 inches (100 cm)
*****soils in muskegs that have over 16 inches (40 cm) of organic material overlying mineral soil and permafrost
*****soils in similar positions with sandy or very gravelly textures within 40 inches (100 cm)
*****soils with slopes greater than 7 percent

Major Uses

Current uses: homesteads, low density housing, and wildlife habitat
Potential uses: hayland and pastureland and forestland

Major Management Factors

Soil-related factors: wind erosion, water erosion, load supporting capacity, depth to permafrost, frost heaving, restricted permeability, thermokarst, depth to perched water table, and low fertility
Elevation: 1400 to 2200 feet (427 to 671 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—60 to 70 days (28 degree base temperature)

Hayland and Pastureland

With permafrost:
General management considerations:
*****Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost and subsequent lowering of the water table.
*****Differential subsidence may occur where massive ice features are present.

Suitable management practices:
*****Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.
*****Leave strips of trees as windbreaks when clearing.

When thawed:
General management considerations:
*****Due to frequent mid-summer frosts and a relatively short frost-free season, the suitable crops for planting are hay, permanent pasture, and grain crops harvested as hay.
*****Additional drainage may be necessary in areas where natural drainage outlets are absent.
*****Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.
*****Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*****Hay crops respond well to fertilizer if precipitation is adequate.
*****Occasional cobbles on the surface may present a hazard to machinery.
*****Small depressional areas that comprise up to 10 percent of this unit remain wet for extended periods in the spring and may delay cultivation.

Suitable management practices:
*****Use conservation tillage to conserve moisture and maintain or improve soil fertility.

*Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*Cultivate on the contour or across the slope to reduce the risk of water erosion.
*Conduct on-site investigations to determine if massive ice features are present.

Forestland

With permafrost:
Principal tree species are: black spruce and white spruce
Common understory plants are: Labrador tea ledum, lowbush cranberry, red bearberry, bog blueberry, and moss
Mean site index and yields: not estimated—the presence of permafrost and the associated perched water table result in stunted growth and low site productivity

General management considerations:
*Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost, lowering of the water table, and increased site productivity.

When thawed:
Principal tree species are: white spruce and quaking aspen
Common understory plants are: tall willow, lowbush cranberry, Labrador tea ledum, soapberry, pumpkinberry, black crowberry, and moss

General management considerations:
*Productivity of maturing stands may decline significantly as the permafrost and associated water table rise within the soil profile.
*Logging roads may require ballast.
*The soil has low bearing capacity and is poor roadbuilding material.
*Because cold soil temperatures restrict roots, trees are moderately subject to windthrow.
*Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*Trees suitable for planting are white spruce.

Suitable management practices:
*Use conventional equipment in harvesting but limit its use when the soil is wet.
*Seed cuts and fills and stabilize cuts with a grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

With permafrost:
General management considerations:
*Excavation is hampered by permafrost.
*Excavation can expose material that is highly susceptible to wind erosion.
*Excavation increases the risk of water erosion.
*Frost action limits construction of access roads, driveways, and buildings.
*Local roads may require a special base to prevent permafrost damage.
*Septic tank absorption fields may function poorly because of wetness and the limited depth to permafrost, which restrict the movement and infiltration of effluent.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.
*Construct buildings on thick gravel pads to reduce subsidence caused by the melting of permafrost.
*Leave the vegetation and organic mat intact where it is desirable to maintain the present level of permafrost.
*Underlay roads with gravel to minimize frost action.
*Clearing large areas with obvious surface drainage outlets results in the eventual subsidence of the permafrost and water table to below 60 inches (152 cm).

When thawed:
General management considerations:
*Excavation increases the risk of water erosion.
*Excavation can expose material that is highly susceptible to wind erosion.
*Frost action limits construction of access roads, driveways, and buildings.
*Depressional areas that comprise up to 10 percent of the unit remain wet after clearing.
*Septic tank absorption fields may function poorly because of degraded soil structure and reduced permeability upon addition of effluent.
*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.

*Consider the depth to which annual frosts penetrate when designing footings and road bases.
*Increase the size of the septic absorption area to compensate for the restricted permeability.
*Provide drainage to reduce wetness if roads and buildings are to be constructed in depressional areas.
*Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Conduct on-site investigations to determine if massive ice features are present.
*Underlay roads with gravel to minimize frost action.

455—Chetaslina silt loam, 0 to 7 percent slopes

Composition

Chetaslina silt loam and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Chetaslina Soil

Positions on landscape: broad lacustrine terraces
Slope range: 0 to 7 percent
Slope features: plane
Organic mat on surface: 2 to 5 inches (5 to 12 cm) thick
Native vegetation: white spruce, aspen, tall willow, low and dwarf shrubs, and herbs

Typical profile:
*0 to 7 inches (0 to 18 cm)—dark grayish brown and brown silt loam
*7 to 12 inches (18 to 30 cm)—dark grayish brown silty clay loam
*12 to 30 inches (30 to 76 cm)—olive gray gravelly loam
*30 to 60 inches (76 to 152 cm)—dark gray gravelly loam

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: high
Depth to contrasting loamy lacustrine material: 4 to 13 inches (10 to 33 cm)
Runoff: slow
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in similar positions and muskegs with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*soils in similar positions that have sandy material within 40 inches (100 cm)
*soils in similar positions that have very cobbly or very gravelly surface textures within 3 inches (8 cm) of the surface
*soils that have slopes of more than 7 percent

Major Uses

Current uses: homesteads and wildlife habitat
Potential uses: hayland and pastureland and forestland

Major Management Factors

Soil-related factors: wind erosion, water erosion, frost heaving, load supporting capacity, restricted permeability, and low fertility
Elevation: 1400 to 2200 feet (427 to 670 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*frost-free period—60 to 80 days (28 degree base temperature)

Hayland and Pastureland

General management considerations:
*Due to frequent mid-summer frosts and a relatively short frost-free season, suitable crops for planting are hay, permanent pasture, and grain crops harvested as hay.
*Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*Hay crops respond well to fertilizer if precipitation is adequate.
*Occasional boulders and cobbles may present a hazard to machinery.
*Small depressional areas that comprise up to 10 percent of this unit remain wet for extended periods in the spring and may delay cultivation.
*Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.

Suitable management practices:
*Use conservation tillage and farm on the contour to conserve moisture.

*Use conservation tillage to maintain or improve soil fertility.
*Use shallow cuts when land smoothing to avoid exposing areas of cobbly and/or gravelly material.
*Cultivate and seed on the contour or across the slope to reduce the risk of water erosion.
*Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*Leave strips of trees as windbreaks when clearing.
*Conduct on-site investigations to determine if deep massive ice features are present.

Forestland

Principal tree species are: white spruce and quaking aspen
Common understory plants are: tall willow, Labrador tea ledum, soapberry, lowbush cranberry, black crowberry, bearberry, pumpkinberry, and moss
Estimated site index (100 year site curve) for stated species: white spruce—69
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—900 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2390 cubic feet/acre *(Farr 1967)*

General management considerations:
*Productivity of maturing stands may decline significantly as permafrost and the associated perched water table rise within the soil profile.
*Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*Logging roads may require ballast.
*The soil has low bearing capacity and is a poor source of roadbuilding material.
*Because cold soil temperatures restrict roots, trees are subject to windthrow.
*Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*Trees suitable for planting are white spruce.

Suitable management practices:
*Use conventional equipment in harvesting, but limit its use when the soil is wet.
*Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

Chetaslina soil:
General management considerations:
*Excavation can expose soil material that is highly susceptible to wind erosion.
*Excavation increases the risk of water erosion.
*The quality of roadbeds and road surfaces is adversely affected by frost action and limited soil strength.
*Septic tank absorption fields may function poorly because of the restricted permeability of the soil.

*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Increase the size of the septic absorption areas to compensate for the restricted permeability.
*Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Consider the depth to which annual frosts penetrate when designing footings and road bases.
*Conduct on-site investigations to determine if massive ice features are present.
*Underlay roads with gravel to minimize frost action.

456—Chetaslina silt loam, thin surface, 0 to 7 percent slopes

Composition

Chetaslina silt loam and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Chetaslina Soil

Positions on landscape: broad lacustrine terraces
Slope range: 0 to 7 percent
Slope features: plane
Organic mat on surface: 2 to 5 inches (5 to 12 cm) thick
Native vegetation: white spruce, aspen, tall willow, low and dwarf shrubs, and herbs

Typical profile:
*0 to 1 inch (0 to 3 cm)—brown silt loam
*1 to 5 inches (3 to 13 cm)—olive gray clay loam
*5 to 60 inches (13 to 152 cm)—olive gray cobbly clay loam

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: high
Depth to contrasting loamy lacustrine material: 1 to 3 inches (2 to 8 cm)
Runoff: slow to medium
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in similar positions and muskegs with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*****soils in similar positions that have sandy material within 40 inches (100 cm)
*****soils in similar positions that have very cobbly or very gravelly surface textures
*****soils that have slopes of more than 7 percent

Major Uses

Current uses: homesteads and wildlife habitat
Potential uses: hayland and pastureland and forestland

Major Management Factors

Soil-related factors: wind erosion, water erosion, frost heaving, load supporting capacity, restricted permeability, low fertility, and cobbles
Elevation: 1400 to 2200 feet (427 to 670 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—60 to 80 days (28 degree base temperature)

Hayland and Pastureland

General management considerations:
*****Due to frequent mid-summer frosts and a relatively short frost-free season, suitable crops for planting are hay, permanent pasture, and grain crops harvested as hay.
*****Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*****Hay crops respond well to fertilizer if precipitation is adequate.
*****The large number of cobbles within the plow depth limits fieldwork.
*****Small depressional areas that comprise up to 10 percent of this unit remain wet for extended periods in the spring and may delay cultivation.
*Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.

Suitable management practices:
*****Use conservation tillage and farm on the contour to conserve moisture.
*****Use conservation tillage to maintain or improve soil fertility.
*****Cultivate and seed on the contour or across the slope to reduce the risk of water erosion.
*****Seed to permanent hay or pasture, plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*****Leave strips of trees as windbreaks when clearing.
*****Conduct on-site investigations to determine if deep massive ice features are present.

Forestland

Principal tree species are: white spruce and quaking aspen
Common understory plants are: tall willow, Labrador tea ledum, soapberry, lowbush cranberry, black crowberry, bearberry, pumpkinberry, and moss
Estimated site index (100 year site curve) for stated species: white spruce—69
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—900 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2390 cubic feet/acre *(Farr 1967)*

General management considerations:
*****Productivity of maturing stands may decline significantly as permafrost and the associated perched water table rise within the soil profile.
*****Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*****Logging roads may require ballast.
*****The soil has low bearing capacity and is a poor source of roadbuilding material.
*****Because cold soil temperatures restrict roots, trees are subject to windthrow.
*****Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.

*Trees suitable for planting are white spruce.

Suitable management practices:
*Use conventional equipment in harvesting, but limit its use when the soil is wet.
*Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

General management considerations:
*Excavation can expose soil material that is highly susceptible to wind erosion.
*Excavation increases the risk of water erosion.
*The quality of roadbeds and road surfaces is adversely affected by frost action and limited soil strength.
*Septic tank absorption fields may function poorly because of the restricted permeability of the soil.
*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Increase the size of the septic absorption areas to compensate for the restricted permeability.
*Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Consider the depth to which annual frosts penetrate when designing footings and road bases.
*Conduct on-site investigations to determine if massive ice features are present.
*Underlay roads with gravel to minimize frost action.

457—Mendeltna-Tebay complex, 0 to 10 percent slopes

Composition

Mendeltna peat and similar inclusions: 55 percent
Tebay silt loam and similar inclusions: 30 percent
Contrasting inclusions: 15 percent

Characteristics of Mendeltna Soil

Positions on landscape: broad lacustrine terraces
Slope range: 0 to 6 percent
Slope features: plane to concave
Organic mat on surface: 8 to 14 inches (20 to 36 cm) thick
Native vegetation: black and white spruce, low and dwarf shrubs, herbs, and moss

Typical profile:
*9 inches to 0 (23 cm to 0)—dark reddish brown peat and black mucky peat consisting of fibrous and partially decomposed roots, moss, and twigs
*0 to 1 inch (0 to 2 cm)—very dark brown mucky silt loam
*1 to 16 inches (2 to 41 cm)—dark grayish brown loam
*16 to 26 inches (41 to 66 cm)—perennially frozen, olive gray clay loam

Drainage class: very poorly drained or poorly drained
Permeability: in the organic mat—moderately rapid; in the mineral soil above the permafrost—moderate; in the permafrost—impermeable
Available water capacity: including organic mat—low
Root restricting feature: permafrost
Depth to permafrost: 14 to 29 inches (36 to 74 cm) below the surface of the mineral soil
Depth to contrasting loamy lacustrine material: 1 to 8 inches (2 to 20 cm) below the surface of the mineral soil
Runoff: slow
Depth to perched water table: 12 to 24 inches (30 to 61 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Characteristics of Tebay Soil

Positions on landscape: broad lacustrine terraces
Microtopography: drumlins and moraines
Slope range: 0 to 10 percent
Slope features: convex
Organic mat on surface: 2 to 5 inches (5 to 12 cm) thick
Native vegetation: aspen, tall willow, dwarf shrubs, herbs, and scattered moss

Typical profile:
*0 to 2 inches (0 to 5 cm)—dark brown and brown silt loam
*2 to 12 inches (5 to 30 cm)—olive gray gravelly fine sandy loam
*12 to 60 inches (30 to 152 cm)—olive gray sandy loam

Drainage class: well drained
Permeability: moderate
Available water capacity: moderate

Depth to loamy glacial till: 1 to 8 inches (2 to 20 cm) below the surface of the mineral soil
Runoff: slow
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in muskegs that have over 16 inches (40 cm) of organic material overlying mineral soil and permafrost
*****soils in similar positions with clayey or very gravelly textures within 40 inches (100 cm)
*****soils with slopes greater than 10 percent

Major Uses

Current uses: wildlife habitat
Potential uses: hayland and pastureland, forestland, homesteads, low density housing, and roadfill

Major Management Factors

Soil-related factors: wind erosion, water erosion, load supporting capacity, depth to permafrost, frost heaving, restricted permeability, thermokarst, depth to perched water table, and low fertility
Elevation: 1400 to 2000 feet (427 to 610 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—60 to 70 days (28 degree base temperature)

Hayland and Pastureland

Mendeltna soil with permafrost:
General management considerations:
*****Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost and subsequent lowering of the water table.
*****Differential subsidence may occur where massive ice features are present.

Suitable management practices:
*****Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.
*****Leave strips of trees as windbreaks when clearing.

Mendeltna soil when thawed:
General management considerations:
*****Due to frequent mid-summer frosts and a relatively short frost-free season, the suitable crops for planting are hay, permanent pasture, and grain crops harvested as hay.
*****Additional drainage may be necessary in areas where natural drainage outlets are absent.
*****Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.
*****Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*****Hay crops respond well to fertilizer if precipitation is adequate.
*****Occasional boulders and cobbles on the surface may present a hazard to machinery.
*****Small depressional areas that comprise up to 10 percent of this unit remain wet for extended periods in the spring and may delay cultivation.

Suitable management practices:
*****Use conservation tillage to conserve moisture and maintain or improve soil fertility.
*****Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*****Seed to permanent hay or pasture and cultivate on the contour or across the slope to reduce the risk of water erosion.
*****Conduct on-site investigations to determine if massive ice features are present.

Tebay soil:
General management considerations:
*****Due to frequent mid-summer frosts and a relatively short frost-free season, the suitable crops for planting are hay, permanent pasture, and grain crops harvested as hay.
*****Hay crops respond well to fertilizer if precipitation is adequate.
*****The large number of cobbles on the surface limits fieldwork.

Suitable management practices:
*****Use conservation tillage to conserve moisture and maintain or improve soil fertility.
*****Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width

of strips of unprotected soils to reduce the risk of wind erosion.
*****Seed to permanent hay or pasture and cultivate on the contour or across the slope to reduce the risk of water erosion.
*****Leave strips of trees as windbreaks when clearing.

Forestland

Mendeltna soil with permafrost:
Principal tree species are: black spruce and white spruce
Common understory plants are: Labrador tea ledum, lowbush cranberry, red bearberry, bog blueberry, and moss
Mean site index and yields: not estimated—the presence of permafrost and the associated perched water table result in stunted growth and low site productivity

General management considerations:
*****Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost, lowering of the water table, and increased site productivity.

Mendeltna soil when thawed:
Principal tree species are: white spruce and quaking aspen
Common understory plants are: tall willow, lowbush cranberry, Labrador tea ledum, soapberry, pumpkinberry, black crowberry, and moss
Estimated site index (100 year site curve) for stated species: white spruce—69
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees older than 8.5 inches diameter at breast height—900 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2300 cubic feet/acre *(Farr 1967)*

General management considerations:
*****Productivity of maturing stands may decline significantly as the permafrost and associated water table rise within the soil profile.
*****Logging roads may require ballast.
*****The soil has low bearing capacity and is poor roadbuilding material.
*****Because cold soil temperatures restrict roots, trees are moderately subject to windthrow.
*****Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*****Trees suitable for planting are white spruce.

Suitable management practices:
*****Use conventional equipment in harvesting, but limit its use when the soil is wet.
*****Seed cuts and fills and stabilize cuts with a grass straw mulch to reduce the risk of erosion.
*****Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Tebay soil:
General management considerations:
*****This soil supports mostly small diameter quaking aspen and has limited potential for forestland management.

Building Site Development

Mendeltna soil with permafrost:
General management considerations:
*****Excavation is hampered by permafrost.
*****Excavation can expose material that is highly susceptible to wind erosion.
*****Excavation increases the risk of water erosion.
*****Local roads may require a special base to prevent permafrost damage.
*****Septic tank absorption fields may function poorly because of wetness and the limited depth to permafrost, which restrict the movement and infiltration of effluent.

Suitable management practices:
*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*****Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.
*****Construct buildings on thick gravel pads to reduce subsidence caused by the melting of permafrost.
*****Leave the vegetation and organic mat intact where it is desirable to maintain the present level of permafrost.
*****Underlay roads with gravel to minimize frost action.
*****Clearing large areas with obvious surface drainage outlets results in the eventual subsidence of the permafrost and water table to below 60 inches (152 cm).

Mendeltna soil when thawed:
General management considerations:
*****Excavation increases the risk of water erosion.
*****Excavation can expose material that is highly susceptible to wind erosion.
*****Frost action limits construction of access roads, driveways, and buildings.
*****Septic tank absorption fields may function poorly because of degraded soil structure and reduced permeability upon addition of effluent.

*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Consider the depth to which annual frosts penetrate when designing footings and road bases.
*Increase the size of the septic absorption area to compensate for the restricted permeability.
*Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Conduct on-site investigations to determine if massive ice features are present.
*Underlay roads with gravel to minimize frost action.

Tebay soil:
General management considerations:
*This soil is a good source of roadfill.
*Excavation can expose material that is highly susceptible to wind erosion.
*Frost action limits construction of access roads, driveways, and buildings.
*Septic tank absorption fields may function poorly because of degraded soil structure and reduced permeability upon addition of effluent.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Consider the depth to which annual frosts penetrate when designing footings and road bases.
*Increase the size of the septic absorption area to compensate for the restricted permeability.
*Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Underlay roads with gravel to minimize frost action.

458—Nizina-Nizina, rarely flooded, complex, 0 to 5 percent slopes

Composition

Nizina loamy fine sand and similar inclusions: 50 percent
Nizina very fine sandy loam, rarely flooded, and similar inclusions: 35 percent
Contrasting inclusions: 15 percent

Characteristics of Nizina Soil

Positions on landscape: floodplains
Slope range: 0 to 2 percent
Slope features: plane
Organic mat on surface: 0 to 3 inches (0 to 8 cm) thick
Rock fragments on surface: 0 to 15 percent gravel and cobble
Native vegetation: tall alder and willow, horsetail and other herbs, and occasional balsam poplar

Typical profile:
*0 to 4 inches (0 to 10 cm)—very dark grayish brown loamy fine sand
*4 to 60 inches (10 to 152 cm)—dark olive gray extremely cobbly and extremely gravelly sand with lenses and strata of fine sand and sand

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: excessively drained
Permeability: in the surface layers—moderately rapid; in the sand and gravel substratum—rapid
Available water capacity: low
Depth to contrasting gravelly and cobbly material: 2 to 8 inches (5 to 20 cm)
Runoff: slow

Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: occasional—in addition to the spring and summer flooding hazard, intense channel freezing results in a winter flooding hazard

Characteristics of Nizina, Rarely Flooded Soil

Positions on landscape: low stream terraces
Slope range: 0 to 5 percent
Slope features: plane
Organic mat on surface: 0 to 3 inches (0 to 8 cm) thick
Native vegetation: white spruce, balsam poplar, scattered low shrubs, and herbs

Typical profile:
*0 to 3 inches (0 to 8 cm)—very dark grayish brown and dark brown very fine sandy loam
*3 to 60 inches (8 to 152 cm)—dark olive gray extremely cobbly and extremely gravelly sand with lenses and strata of fine sand and sand

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: excessively drained
Permeability: in the surface layers—moderate; in the sand and gravel substratum—rapid
Available water capacity: low
Depth to contrasting gravelly and cobbly material: 2 to 8 inches (5 to 20 cm)
Runoff: slow

Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: rare

Included Areas

*****soils on narrow, steep escarpments
*****soils in similar positions that are sandy throughout the profile
*****soils in similar positions that have very gravelly surfaces
*****riverwash and intermingling river channels
*****soils that have slopes of more than 5 percent

Major Uses

Current uses: low density housing, wildlife habitat, and gravel source
Potential uses: forestland

Major Management Factors

Soil-related factors: available water capacity, cobbles, and flooding
Elevation: 600 to 1500 feet (183 to 457 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—70 to 90 days (28 degree base temperature)

Forestland

Nizina soil:
General management considerations:
*****Occasional flooding has prevented the establishment of trees on this soil.

Nizina, rarely flooded soil:
Principal tree species are: white spruce and balsam poplar
Common understory plants are: twinflower, lupine, pumpkinberry, moss, prickly rose, highbush cranberry, and soapberry
Mean site index (100 year site curve) for stated species (and source): white spruce—69 *(Farr 1967),* based on a sample of 25 trees in 5 plots
Estimated average total production for stated species (and source) at age 100 years: white spruce trees greater than 8.5 inches diameter at breast height—900 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2400 cubic feet/acre *(Farr 1967)*

General management considerations:
*****Road rock and ballast material is readily available, generally at a depth of 2 inches (5 cm) or more.
*****Seeding is advisable if logging or fire have disturbed the soil.
*****Because gravelly material and cold soil temperatures restrict roots, trees are highly subject to windthrow.
*****Because of the limited available water capacity, seedlings are likely to die in areas where understory plants are numerous.
*****Trees suitable for planting are white spruce.

Suitable management practices:
*****Use conventional equipment in harvesting.
*****Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

Nizina soil:
General management considerations:
*****This soil has severe limitations for homesteads and urban development due to the occasional flooding hazard.
*****This soil is a good source of gravel and a fair source of roadfill.

Nizina, rarely flooded soil:
General management considerations:
*****This soil has severe limitations for homesteads and urban development due to the rare flooding hazard.
*****Excavation can expose soil material that is highly susceptible to wind erosion.
*****Streambank erosion presents a hazard to structures.
*****Cutbanks are not stable and are subject to caving.
*****This unit is a fair source of roadfill and a good source of gravel.
*****Septic tank absorption fields may function poorly because of wetness during periods of flooding.
*****The rapid permeability of the substratum may allow effluent from moderate or high density housing to pollute the ground water.

Suitable management practices:
*****Locate structures above the expected flood level, provide interceptor ditches, and establish adequate outlets and drainageways to reduce the risk of flooding.
*****Protect on-site sewage disposal systems from flooding.
*****Establish gently sloping grades on roadcuts and excavations to reduce the risk of caving.

*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.

459—Pippin silt loam, 0 to 12 percent slopes

Composition

Pippin silt loam and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Characteristics of Pippin Soil

Positions on landscape: till plains
Slope range: 0 to 12 percent
Slope features: plane or undulating
Organic mat on surface: 1 to 4 inches (2 to 10 cm) thick
Native vegetation: white spruce, aspen, dwarf shrubs, scattered herbs, and moss

Typical profile:
*0 to 8 inches (0 to 20 cm)—very dark brown and dark brown silt loam
*8 to 60 inches (20 to 152 cm)—dark grayish brown extremely gravelly and extremely cobbly sand

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: somewhat excessively drained
Permeability: in the silty surface layers—moderate; in the sand and gravel substratum—rapid
Available water capacity: low
Depth to sand and gravel: 3 to 9 inches (8 to 23 cm)
Runoff: slow
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in similar positions and muskegs with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*soils in similar positions that have loamy or clayey textures throughout the profile
*soils that have slopes of more than 12 percent

Major Uses

Current uses: homesteads, wildlife habitat, and gravel source
Potential uses: forestland and low density housing

Major Management Factors

Soil-related factors: available water capacity, rapid permeability, water erosion, and wind erosion
Elevation: 1400 to 2200 feet (427 to 671 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*frost-free period—60 to 70 days (28 degree base temperature)

Forestland

Principal tree species are: white spruce and quaking aspen
Common understory plants are: lowbush cranberry, pumpkinberry, lupine, moss, prickly rose, and twinflower
Mean site index (100 year site curve) for stated species (and source): white spruce—69 *(Farr 1967),* based on a sample of 26 trees in 5 plots

Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—900 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2400 cubic feet/acre *(Farr 1967)*

General management considerations:
*Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*Rock and ballast material is readily available, generally at a depth of 3 inches (8 cm) or more.
*Because cold soil temperatures and gravelly material restrict roots, trees are highly subject to windthrow.
*Because of the limited available water capacity, seedlings are likely to die in areas where understory plants are numerous.
*Trees suitable for planting are white spruce.

Suitable management practices:
*Use conventional equipment in harvesting, but limit its use when the soil is wet.
*Avoid excessive disturbance on the soil and seed roads, cutbanks, and landings to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

General management considerations:
*Excavation can expose soil material that is highly susceptible to wind erosion.

*Excavation increases the risk of water erosion.
*Cutbanks are not stable and are subject to caving.
*Excavation is hampered by the cobbles in the soil.
*This unit is a good source of gravel and a fair source of roadfill.
*The rapid permeability of the substratum may allow effluent from moderate or high density housing to pollute the ground water.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Install septic absorption lines in adjacent areas that are more nearly level.
*Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Establish gently sloping grades on roadcuts and excavations to reduce the risk of caving.

460—Pippin silt loam, 12 to 45 percent slopes

Composition

Pippin silt loam and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Characteristics of Pippin Soil

Positions on landscape: till plains
Slope range: 12 to 45 percent
Slope features: plane to convex
Organic mat on surface: 1 to 4 inches (2 to 10 cm) thick
Native vegetation: white spruce, aspen, dwarf shrubs, scattered herbs, and moss

Typical profile:
*0 to 8 inches (0 to 20 cm)—very dark brown and dark brown silt loam
*8 to 60 inches (20 to 152 cm)—dark grayish brown extremely gravelly and extremely cobbly sand

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: somewhat excessively drained
Permeability: in the silty surface layers—moderate; in the sand and gravel substratum—rapid
Available water capacity: low
Depth to sand and gravel: 3 to 9 inches (8 to 23 cm)
Runoff: rapid
Hazard of erosion: by water—moderate if the organic mat is not removed, severe if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in depressions with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*soils in similar positions that have loamy or clayey textures throughout the profile
*soils that have slopes of less than 12 percent or more than 45 percent

Major Uses

Current uses: wildlife habitat and gravel source

Major Management Factors

Elevation: 1400 to 2200 feet (427 to 671 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*frost-free period—60 to 70 days (28 degree base temperature)

461—Riverwash-Nizina complex, 0 to 2 percent slopes

Composition

Riverwash: 45 percent
Nizina loamy fine sand and similar inclusions: 45 percent
Contrasting inclusions: 10 percent

Characteristics of Riverwash

Positions on landscape: floodplains
Slope range: 0 to 2 percent
Slope features: plane—with many short, steep escarpments
Native vegetation: scattered sparse low shrubs
Material: stratified sand, gravel, cobbles, and stones
Hazard of flooding: frequent

Characteristics of Nizina Soil

Positions on landscape: floodplains
Slope range: 0 to 2 percent
Slope features: plane—with many short, steep escarpments
Organic mat on surface: 1 to 2 inches (2 to 5 cm) thick
Native vegetation: tall alder and willow, horsetail and other herbs, and occasional balsam poplar

Typical profile:
*0 to 2 inches (0 to 5 cm)—very dark grayish brown loamy fine sand
*2 to 60 inches (5 to 152 cm)—dark olive gray stratified extremely cobbly and extremely gravelly sand with lenses of fine sand

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: excessively drained
Permeability: in the surface layers—moderately rapid; in the sand and gravel substratum—rapid
Available water capacity: low
Depth to contrasting gravelly and cobbly material: 2 to 8 inches (5 to 20 cm)
Runoff: slow
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: frequent—in addition to the spring and summer flooding hazard, intense channel freezing causes a winter flooding hazard

Included Areas

*soils on narrow, steep escarpments
*soils in similar positions that have very gravelly surfaces
*river channels

Major Uses

Current uses: wildlife habitat and gravel source

Major Management Factors

Elevation: 600 to 1500 feet (183 to 457 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*frost-free period—70 to 90 days (28 degree base temperature)

462—Taral mucky silt loam, 20 to 45 percent slopes

Composition

Taral mucky silt loam and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Characteristics of Taral Soil

Positions on landscape: till plains
Microtopography: back slopes and shoulder slopes of hills
Slope range: 20 to 45 percent
Slope features: convex
Organic mat on surface: 1 to 5 inches (3 to 13 cm) thick
Native vegetation: white spruce, paper birch, tall alder and willow, low and dwarf shrubs, and moss

Typical profile:
*0 to 3 inches (0 to 8 cm)—black mucky silt loam
*3 to 28 inches (8 to 71 cm)—black and dark mucky silt loam and silt loam
*28 to 60 inches (71 to 152 cm)—dark grayish brown gravelly sandy loam

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: high
Depth to contrasting till material: 15 to 38 inches (38 to 96 cm)
Runoff: rapid
Hazard of erosion: by water—severe if the organic mat is not removed, severe if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in muskegs that have over 16 inches (40 cm) of organic material over mineral soil
*soils in similar positions that have sandy or very gravelly textures at less than 10 inches (25 cm)
*soils in similar positions that have silty substratums
*rock outcroppings
*soils that have slopes of less than 20 percent or more than 45 percent

Major Uses

Current uses: wildlife habitat
Potential uses: forestland

Major Management Factors

Soil-related factors: slope, wind erosion, water erosion, and rock outcroppings
Elevation: 1200 to 2200 feet (365 to 670 m)

Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*frost-free period—60 to 90 days (28 degree base temperature)

Forestland

Principal tree species are: white spruce and paper birch
Common understory plants are: American green alder, tall willow, Labrador tea ledum, prickly rose, lowbush cranberry, black crowberry, highbush cranberry, and moss
Site index and yields: not estimated

General management considerations:
*Productivity of maturing stands may decline significantly as the permafrost rises within the soil profile.
*The main limitation for the harvesting of timber is slope.
*Since the soil is highly erosive, only those logging methods that do not disturb the organic mat should be employed, otherwise siltation of nearby streams may result.
*Road failure and landslides are likely to occur after road construction and clear cutting.
*Adequately designed drainage systems reduce the risk of concentrated flow erosion on roadways.
*If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*Because cold soil temperatures restrict roots, trees are moderately subject to windthrow.
*Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*Trees suitable for planting are white spruce and paper birch.

Suitable management practices:
*Use logging methods that disturb the soil least to reduce the risk of sliding and slumping during harvest.
*Avoid excessive disturbance on the soil, seed cuts and fills, and stabilize cuts with a grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

463—Taral-Hanagita complex, 12 to 35 percent slopes

Composition

Taral mucky silt loam and similar inclusions: 65 percent
Hanagita silt loam and similar inclusions: 25 percent
Contrasting inclusions: 0 percent

Characteristics of Taral Soil

Positions on landscape: till plains
Microtopography: back slopes and shoulder slopes of hills
Slope range: 20 to 35 percent
Slope features: convex
Organic mat on surface: 1 to 5 inches (3 to 13 cm) thick
Native vegetation: white spruce, paper birch, tall alder and willow, low and dwarf shrubs, and moss
Typical profile:
*0 to 2 inches (0 to 5 cm)—black mucky silt loam
*2 to 22 inches (5 to 55 cm)—black and dark yellowish brown mucky silt loam and silt loam
*22 to 60 inches (55 to 152 cm)—dark grayish brown gravelly sandy loam

Depth class: very deep (more than 60 inches, or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: high
Depth to contrasting till material: 15 to 38 inches (38 to 96 cm)
Runoff: rapid
Hazard of erosion: by water—severe if the organic mat is not removed, severe if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Characteristics of Hanagita Soil

Positions on landscape: hills
Microtopography: ridge tops and shoulder slopes
Slope range: 12 to 35 percent
Slope features: convex
Organic mat on surface: 2 to 5 inches (5 to 13 cm) thick

Native vegetation: white spruce, tall willow, low shrubs, and moss

Typical profile:
*0 to 7 inches (0 to 18 cm)—dark brown silt loam
*7 to 15 inches (18 to 38 cm)—dark yellowish brown silt loam
*15 to 18 inches (38 to 46 cm)—brown gravelly silt loam
*18 inches (46 cm)—consolidated bedrock

Depth class: shallow (12 to 20 inches, or 30 to 50 cm) over bedrock
Drainage class: well drained
Permeability: moderate
Available water capacity: low
Runoff: rapid
Hazard of erosion: by water—severe if the organic mat is not removed, severe if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in muskegs that have over 16 inches (40 cm) of organic material over mineral soil
*soils in similar positions that have sandy or very gravelly textures at less than 10 inches (25 cm)
*rock outcroppings

*soils that have slopes of less than 12 percent or more than 35 percent

Major Uses

Current uses: wildlife habitat
Potential uses: forestland

Major Management Factors

Soil-related factors: slope, wind erosion, water erosion, and rock outcroppings
Elevation: 1200 to 2200 feet (365 to 670 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*frost-free period—60 to 90 days (28 degree base temperature)

Forestland

Taral soil:
Principal tree species are: white spruce and paper birch
Common understory plants are: American green alder, tall willow, Labrador tea ledum, prickly rose, lowbush cranberry, black crowberry, highbush cranberry, and moss
Site index and yields: not estimated

General management considerations:
*Productivity of maturing stands may decline significantly as the permafrost rises within the soil profile.
*The main limitation for the harvesting of timber is slope.
*Since the soil is highly erosive, only those logging methods that do not disturb the organic mat should be employed, otherwise siltation of nearby streams may result.
*Road failure and landslides are likely to occur after road construction and clear cutting.
*Adequately designed drainage systems reduce the risk of concentrated flow erosion on roadways.
*If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*Because cold soil temperatures restrict roots, trees are moderately subject to windthrow.
*Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*Trees suitable for planting are white spruce and paper birch.

Suitable management practices:
*Use logging methods that disturb the soil least to reduce the risk of sliding and slumping during harvest.
*Avoid excessive disturbance on the soil, seed cuts and fills, and stabilize cuts with a grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Hanagita soil:
Principal tree species are: white spruce and paper birch
Common understory plants are: tall willow, alder, prickly rose, lowbush cranberry, black crowberry, and moss
Site index and yields: not estimated

General management considerations:
*The main limitation for the harvesting of timber is slope.
*Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*Adequately designed drainage systems reduce the risk of concentrated flow erosion on roadways.
*The upper 12 to 20 inches (30 to 50 cm) of the soil

have low bearing capacity and are poor roadbuilding material.
*If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*Because cold soil temperatures restrict roots, trees are moderately subject to windthrow.
*Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*Trees suitable for planting are white spruce and paper birch.

Suitable management practices:
*Use conventional equipment in harvesting, but limit its use when the soil is wet.
*Seed cuts and fills and stabilize cuts with grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

464—Strelna-Hanagita-Copper River complex, 15 to 55 percent slopes

Composition

Strelna peat and similar inclusions: 50 percent
Hanagita silt loam and similar inclusions: 20 percent
Copper River peat and similar inclusions: 20 percent
Contrasting inclusions: 10 percent

Characteristics of Strelna Soil

Positions on landscape: till plains
Microtopography: back slopes of hills
Slope range: 20 to 45 percent
Slope features: convex
Organic mat on surface: 8 to 15 inches (20 to 38 cm) thick
Native vegetation: white and black spruce, tall alder, low and dwarf shrubs, and moss

Typical profile:
*13 inches to 0 (33 cm to 0)—very dark brown peat consisting of decomposing organic material with lenses of very dark brown and dark brown mucky silt loam
*0 to 10 inches (0 to 25 cm)—very dark brown and black mucky silt loam
*10 to 20 inches (25 to 50 cm)—perennially frozen, very dark brown mucky silt loam

Drainage class: well drained
Permeability: in the organic mat—moderately rapid; in the mineral soil above the permafrost—moderate; in the permafrost—impermeable
Available water capacity: including organic mat—moderate
Root restricting feature: permafrost
Depth to permafrost: 0 to 10 inches (0 to 25 cm) below the surface of the mineral soil
Runoff: medium
Hazard of erosion: by water—slight if the organic mat is not removed, severe if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Characteristics of Hanagita Soil

Positions on landscape: hills
Microtopography: ridge tops and shoulder slopes
Slope range: 25 to 55 percent
Slope features: convex
Organic mat on surface: 2 to 5 inches (5 to 13 cm) thick
Native vegetation: white spruce, tall willow, low shrubs, and moss

Typical profile:
*0 to 7 inches (0 to 18 cm)—dark brown silt loam
*7 to 15 inches (18 to 38 cm)—dark yellowish brown silt loam
*15 to 18 inches (38 to 46 cm)—brown gravelly silt loam
*18 inches (46 cm)—consolidated bedrock

Depth class: shallow (12 to 20 inches, or 30 to 50 cm) over bedrock
Drainage class: well drained
Permeability: moderate
Available water capacity: low
Runoff: rapid
Hazard of erosion: by water—severe if the organic mat is not removed, severe if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Characteristics of Copper River Soil

Positions on landscape: hills
Microtopography: toeslopes
Slope range: 15 to 20 percent
Slope features: plane or concave
Organic mat on surface: 8 to 14 inches (20 to 36 cm) thick
Native vegetation: dwarf black and white spruce, low and dwarf shrubs, and moss

Typical profile:
*9 inches to 0 (23 cm to 0)—dark brown peat

consisting of decomposing organic material
*0 to 4 inches (0 to 10 cm)—black mucky silt loam
*4 to 14 inches (10 to 36 cm)—perennially frozen, black silt loam

Drainage class: very poorly drained
Permeability: in the organic mat—moderately rapid; in the mineral soil above the permafrost—moderate; in the permafrost—impermeable
Available water capacity: including organic mat—low
Root restricting feature: permafrost
Depth to permafrost: 0 to 10 inches (0 to 25 cm) below the surface of the mineral soil
Runoff: medium
Depth to perched water table: 0 to 10 inches (0 to 25 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in muskegs that have over 16 inches (40 cm) of organic material over mineral soil
*rock outcroppings
*soils that have slopes of less than 15 percent or more than 55 percent

Major Uses

Current uses: wildlife habitat
Potential uses: forestland

Major Management Factors

Soil-related factors: slope, wind erosion, water erosion, rock outcroppings, depth to permafrost, and depth to perched water table
Elevation: 800 to 2100 feet (244 to 640 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*frost-free period—60 to 90 days (28 degree base temperature)

Forestland

Strelna soil with permafrost:
Principal tree species are: white spruce, black spruce, and paper birch
Common understory plants are: American green alder, tall willow, Labrador tea ledum, prickly rose, lowbush cranberry, black crowberry, highbush cranberry, and moss
Site index and yields: not estimated

General management considerations:
*Clearing large areas results in thawing of the permafrost.

Strelna soil when thawed:
Principal tree species are: white spruce and paper birch
Common understory plants are: American green alder, tall willow, Labrador tea ledum, prickly rose, lowbush cranberry, black crowberry, highbush cranberry, and moss
Site index and yields: not estimated

General management considerations:
*After thawing, variable substratum materials result in variations in management considerations and practices.
*On-site investigation is necessary to determine the nature of the substratum materials. Refer to map unit 462 for applicable management considerations and practices.

Hanagita soil:
Principal tree species are: white spruce and paper birch
Common understory plants are: tall willow, alder, prickly rose, lowbush cranberry, black crowberry, and moss
Site index and yields: not estimated

General management considerations:
*The main limitation for the harvesting of timber is slope.
*Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*Adequately designed drainage systems reduce the risk of concentrated flow erosion on roadways.
*The upper 12 to 20 inches (30 to 50 cm) of the soil have low bearing capacity and are poor roadbuilding material.
*If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*Because cold soil temperatures and shallow soil depth restrict roots, trees are subject to windthrow.
*Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*Trees suitable for planting are white spruce and paper birch.

Suitable management practices:
*Use conventional equipment in harvesting, but limit its use when the soil is wet.

*Seed cuts and fills and stabilize cuts with grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Copper River soil with permafrost:
Principal tree species are: white and black spruce
Common understory plants are: alder, Labrador tea ledum, prickly rose, lowbush cranberry pumpkinberry, and moss
Site index and yields: not estimated—the presence of permafrost and the associated perched water table result in stunted tree growth and low site productivity

General management considerations:
*Clearing large areas results in thawing of the permafrost, lowering of the water table, and increased site productivity.

Copper River soil when thawed:
Principal tree species are: white spruce and paper birch
Common understory plants are: alder, tall willow, prickly rose, lowbush cranberry, pumpkinberry, and northern reedgrass
Site index and yields: not estimated

General management considerations:
*Site productivity increases after thawing; however, variable substratum materials result in variations in site index values.
*On-site investigation is necessary to determine the nature of the substratum materials. Depending on which substratum is found, refer to map units 410, 414 or 418 for applicable management considerations and practices.
*Productivity of maturing stands may decline significantly as permafrost and the associated water table rise in the soil profile.

465—Tebay silt loam, 0 to 7 percent slopes

Composition

Tebay silt loam and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Tebay Soil

Positions on landscape: broad lacustrine terraces
Microtopography: drumlins and moraines
Slope range: 0 to 7 percent
Slope features: plane or convex
Organic mat on surface: 2 to 5 inches (5 to 12 cm) thick
Native vegetation: aspen, tall willow, dwarf shrubs, herbs, and scattered moss

Typical profile:
*0 to 4 inches (0 to 10 cm)—black and dark brown silt loam
*4 to 60 inches (10 to 152 cm)—dark grayish brown, olive gray, and dark gray loam and fine sandy loam

Depth class: very deep (more than 60 inches or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: moderate
Depth to loamy glacial till: 4 to 8 inches (10 to 20 cm) below the surface of the mineral soil
Runoff: slow
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in depressions between drumlins with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)

*soils in similar positions with clayey textures within 40 inches (100 cm)
*soils in similar positions that have very cobbly, very gravelly, or sandy surface textures
*soils with slopes greater than 7 percent

Major Uses

Current uses: wildlife habitat
Potential uses: hayland and pastureland, homesteads, and roadfill

Major Management Factors

Soil-related factors: wind erosion, water erosion, frost heaving, restricted permeability, and low fertility
Elevation: 1400 to 2200 feet (427 to 670 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*frost-free period—60 to 70 days (28 degree base temperature)

Hayland and Pastureland

General management considerations:
*Due to frequent mid-summer frosts and a relatively short frost-free season, the suitable crops for planting are hay, permanent pasture, and grain crops harvested as hay.
*Hay crops respond well to fertilizer if precipitation is adequate.
*Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*Occasional boulders and cobbles may present a hazard to machinery.

Suitable management practices:
*Use conservation tillage and farm on the contour to conserve moisture.
*Use conservation tillage to maintain or improve soil fertility.
*Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*Seed to permanent hay and pasture, cultivate on the contour or across the slope, and maintain crop residue on or near the surface to reduce the risk of water erosion.
*Leave strips of trees as windbreaks when clearing.

Forestland

Tebay soil:
General management considerations:
*This soil supports mostly small diameter quaking aspen and has limited potential for forestland management.

Building Site Development

General management considerations:
*This soil is a good source of roadfill.
*Excavation can expose material that is highly susceptible to wind erosion.
*Excavation increases the risk of water erosion.
*Frost action limits construction of access roads, driveways, and buildings.
*Septic tank absorption fields may function poorly because of the restricted permeability of the soil.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Consider the depth to which annual frosts penetrate when designing footings and road bases.
*Increase the size of the septic absorption area to compensate for the restricted permeability.
*Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Underlay roads with gravel to minimize frost action.

466—Tebay silt loam, 7 to 20 percent slopes

Composition

Tebay silt loam and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Tebay Soil

Positions on landscape: broad lacustrine terraces
Microtopography: drumlins and moraines
Slope range: 7 to 20 percent
Slope features: convex
Organic mat on surface: 2 to 5 inches (5 to 12 cm) thick
Native vegetation: aspen, tall willow, low and dwarf shrubs, scattered herbs, and moss

Typical profile:
*0 to 4 inches (0 to 10 cm)—black and dark brown silt loam
*4 to 60 inches (10 to 152 cm)—dark grayish brown, olive gray, and dark gray loam and fine sandy loam

Depth class: very deep (more than 60 inches or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: moderate
Depth to loamy glacial till: 4 to 8 inches (10 to 20 cm) below the surface of the mineral soil
Runoff: medium
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in depressions between drumlins with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*soils in similar positions that have very cobbly, very gravelly, or sandy surface textures
*soils with slopes of less than 7 percent or greater than 20 percent

Major Uses

Current uses: wildlife habitat
Potential uses: hayland and pastureland, homesteads, and roadfill

Major Management Factors

Soil-related factors: wind erosion, water erosion, frost heaving, slope, restricted permeability, and low fertility
Elevation: 1400 to 2200 feet (427 to 670 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—60 to 70 days (28 degree base temperature)

Hayland and Pastureland

General management considerations:
*****Due to frequent mid-summer frosts and a relatively short frost-free season, the suitable crops for planting are hay, permanent pasture, and grain crops harvested as hay.
*****Hay crops respond well to fertilizer if precipitation is adequate.
*****Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*****Occasional boulders and cobbles may present a hazard to machinery.

Suitable management practices:
*****Use conservation tillage and farm on the contour to conserve moisture.
*****Seed to permanent hay or pasture to reduce the hazard of erosion.
*****Use shallow cuts when land smoothing to avoid exposing areas of cobbly or gravelly material.
*****Cultivate on the contour or across the slope and leave native vegetation intact on steeper areas to reduce the risk of water erosion.
*****Leave strips of trees as windbreaks when clearing.

Forestland

Tebay soil:
General management considerations:
*****This soil supports mostly small diameter quaking aspen and has limited potential for forestland management.

Building Site Development

General management considerations:
*****This soil is a good source of roadfill.
*****Excavation can expose material that is highly susceptible to wind erosion.
*****Excavation increases the risk of water erosion.
*****Frost action limits construction of access roads, driveways, and buildings.
*****Septic tank absorption fields may function poorly because of the restricted permeability of the soil.

Suitable management practices:
*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*****Design and construct buildings and access roads to compensate for the steepness of slope.
*****Install septic absorption lines in adjacent areas that are more nearly level.
*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*****Consider the depth to which annual frosts penetrate when designing footings and road bases.
*****Increase the size of the septic absorption area to compensate for the restricted permeability.
*****Stockpile topsoil and use it to reclaim areas disturbed during construction.
*****Underlay roads with gravel to minimize frost action.

467—Tebay silt loam, thin surface, 0 to 7 percent slopes

Composition

Tebay silt loam, thin surface, and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Tebay Soil

Positions on landscape: broad lacustrine terraces
Microtopography: drumlins and moraines
Slope range: 0 to 7 percent
Slope features: plane or convex
Organic mat on surface: 2 to 5 inches (5 to 12 cm) thick
Native vegetation: aspen, tall willow, low and dwarf shrubs, herbs, and scattered moss

Typical profile:
*****0 to 1 inch (0 to 2 cm)—brown silt loam
*****1 to 14 inches (2 to 36 cm)—dark grayish brown fine sandy loam
*****14 to 60 inches (36 to 152 cm)—dark grayish brown gravelly sandy loam

Depth class: very deep (more than 60 inches, or more than 152 cm)

Drainage class: well drained
Permeability: moderate
Available water capacity: moderate
Depth to loamy glacial till: 1 to 4 inches (2 to 10 cm) below the surface of the mineral soil
Runoff: slow
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in depressions between drumlins with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*****soils in similar positions with clayey textures within 40 inches (100 cm)
*****soils in similar positions that have very cobbly, very gravelly, or sandy surface textures
*****soils with slopes greater than 7 percent

Major Uses

Current uses: homesteads and wildlife habitat
Potential uses: hayland and pastureland and roadfill

Major Management Factors

Soil-related factors: wind erosion, water erosion, frost heaving, cobbles, restricted permeability, and low fertility
Elevation: 1400 to 2200 feet (427 to 670 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—60 to 70 days (28 degree base temperature)

Hayland and Pastureland

General management considerations:
*****There are no acreages of this unit currently cultivated.
*****Due to frequent mid-summer frosts and a relatively short frost-free season, the suitable crops for planting are hay, permanent pasture, and grain crops harvested as hay.
*****Hay crops respond well to fertilizer if precipitation is adequate.
*****Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*****The large numbers of cobbles within the plow depth limit fieldwork.

Suitable management practices:
*****Use conservation tillage and farm on the contour to conserve moisture.
*****Use conservation tillage to maintain or improve soil fertility.
*****Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*****Seed to permanent hay and pasture and cultivate on the contour or across the slope to reduce the risk of water erosion.
*****Leave strips of trees as windbreaks when clearing.

Forestland

Tebay soil:
General management considerations:
*****This soil supports mostly small diameter quaking aspen and has limited potential for forestland management.

Building Site Development

General management considerations:
*****This soil is a good source of roadfill.
*****Excavation can expose material that is highly susceptible to wind erosion.
*****Excavation increases the risk of water erosion.
*****Frost action limits construction of access roads, driveways, and buildings.
*****Septic tank absorption fields may function poorly because of the restricted permeability of the soil.

Suitable management practices:
*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*****Consider the depth to which annual frosts penetrate when designing footings and road bases.
*****Increase the size of the septic absorption area to compensate for the restricted permeability.
*****Stockpile topsoil and use it to reclaim areas disturbed during construction.
*****Underlay roads with gravel to minimize frost action.

468—Tebay silt loam, thin surface, 7 to 20 percent slopes

Composition

Tebay silt loam, thin surface, and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Tebay Soil

Positions on landscape: broad lacustrine terraces
Microtopography: drumlins and moraines
Slope range: 7 to 20 percent
Slope features: convex
Organic mat on surface: 2 to 5 inches (5 to 12 cm) thick
Native vegetation: aspen, tall willow, low and dwarf shrubs, scattered herbs, and moss

Typical profile:
*****0 to 1 inch (0 to 2 cm)—brown silt loam
*****1 to 14 inches (2 to 36 cm)—dark grayish brown fine sandy loam
*****14 to 60 inches (36 to 152 cm)—dark grayish brown gravelly sandy loam

Depth class: very deep (more than 60 inches or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: moderate
Depth to loamy glacial till: 1 to 4 inches (2 to 10 cm) below the surface of the mineral soil
Runoff: medium
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in depressions between drumlins with thick organic mats, saturated conditions, and permafrost at less than 40 inches (100 cm)
*****soils in similar positions that have very cobbly, very gravelly, or sandy surface textures
*****soils with slopes of less than 7 percent or greater than 20 percent

Major Uses

Current uses: wildlife habitat
Potential uses: hayland and pastureland, homesteads, and roadfill

Major Management Factors

Soil-related factors: wind erosion, water erosion, cobbles, frost heaving, slope, restricted permeability, and low fertility
Elevation: 1400 to 2200 feet (427 to 670 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—60 to 70 days (28 degree base temperature)

Hayland and Pastureland

General management considerations:
*****Due to frequent mid-summer frosts and a relatively short frost-free season, the suitable crops for planting are hay, permanent pasture, and grain crops harvested as hay.
*****Hay crops respond well to fertilizer if precipitation is adequate.
*****Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*****The large number of cobbles within the plow depth limits fieldwork.
*****Occasional boulders may present a hazard to machinery.

Suitable management practices:
*****Use conservation tillage to conserve moisture.
*****Seed to permanent hay or pasture to reduce the risk of erosion.
*****Seed to permanent hay or pasture, cultivate and seed on the contour or across the slope, and leave native vegetation intact on steeper areas of this unit to reduce the risk of water erosion.
*****Leave strips of trees as windbreaks when clearing.

Forestland

Tebay soil:
General management considerations:
*****This soil supports mostly small diameter quaking aspen and has limited potential for forestland management.

Building Site Development

General management considerations:
*****This soil is a good source of roadfill.
*****Excavation can expose material that is highly susceptible to wind erosion.
*****Excavation increases the risk of water erosion.
*****Frost action limits construction of access roads, driveways, and buildings.
*****Septic tank absorption fields may function poorly because of the restricted permeability of the soil.

Suitable management practices:
*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*****Design and construct buildings and access roads to compensate for the steepness of slope.
*****Install septic absorption lines in adjacent areas that are more nearly level.
*****Consider the depth to which annual frosts penetrate when designing footings and road bases.
*****Increase the size of the septic absorption area to compensate for the restricted permeability.
*****Locate roads in more gently sloping areas, and design drainage systems to minimize the risk of slumping.
*****Stockpile topsoil and use it to reclaim areas disturbed during construction.
*****Underlay roads with gravel to minimize frost action.

469—Tolsona peat, 0 to 7 percent slopes

Composition

Tolsona peat and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Tolsona Soil

Positions on landscape: till plains
Slope range: 0 to 7 percent
Slope features: plane or concave
Organic mat on surface: 8 to 13 inches (20 to 33 cm) thick
Native vegetation: black and white spruce, low and dwarf shrubs, scattered herbs, and moss

Typical profile:
*****8 inches to 0 (20 cm to 0)—dark reddish brown peat and black mucky peat consisting of fibrous and partially decomposed roots, moss, and twigs
*****0 to 3 inches (0 to 8 cm)—dark brown and black mucky silt loam
*****3 to 24 inches (8 to 61 cm)—dark grayish brown and olive gray gravelly loam and gravelly sandy loam
*****24 to 34 inches (61 to 86 cm)—perennially frozen, olive gray, gravelly sandy loam

Drainage class: very poorly drained or poorly drained
Permeability: in the organic mat—moderately rapid; in the mineral soil above the permafrost—moderate; in the permafrost—impermeable
Available water capacity: including organic mat—moderate
Root restricting feature: permafrost
Depth to permafrost: 14 to 26 inches (36 to 66 cm) below the surface of the mineral soil
Depth to contrasting till material: 1 to 8 inches (3 to 20 cm)
Runoff: slow
Depth to perched water table: 12 to 24 inches (30 to 61 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in similar positions that lack thick organic mats, permafrost, and the associated perched water table within 40 inches (100 cm)
*****soils in muskegs that have over 16 inches (40 cm) of organic material overlying mineral soil
*****soils in similar positions with sandy, clayey, or very gravelly textures within 40 inches (100 cm) of the mineral surface
*****soils with slopes of greater than 7 percent

Major Uses

Current uses: homesteads, low density housing, and wildlife habitat
Potential uses: forestland, hayland and pastureland, and roadfill

Major Management Factors

Soil-related factors: wind erosion, water erosion, depth to permafrost, frost heaving, load supporting capacity, restricted permeability, thermokarst, depth to perched water table, and low fertility
Elevation: 1300 to 2200 feet (335 to 427 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—60 to 70 days (28 degree base temperature)

Hayland and Pastureland

With permafrost:
General management considerations:
*****Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost and subsequent lowering of the water table.
*****Differential subsidence may occur where massive ice features are present.

Suitable management practices:
*****Conduct on-site investigations to determine the

nature and ice content of frozen substrata materials.
*Leave strips of trees as windbreaks when clearing.

When thawed:
General management considerations:
*Due to frequent mid-summer frosts and a relatively short frost-free season, suitable crops for planting include hay, permanent pasture, and grain crops harvested as hay.
*Additional drainage may be necessary in areas where natural drainage outlets are absent.
*Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.
*Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*Hay crops respond well to fertilizer if precipitation is adequate.
*Occasional boulders on the surface may present a hazard to machinery.
*Small depressional areas comprise up to 10 percent of this unit, remain wet for extended periods in the spring, and may delay cultivation.

Suitable management practices:
*Use conservation tillage to conserve moisture.
*Rotate crops and use conservation tillage to maintain or improve soil fertility.
*Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*Seed to permanent hay or pasture, cultivate and seed on the contour or across the slope, and maintain crop residue on or near the surface to reduce the risk of water erosion.
*Conduct on-site investigations to determine if massive ice features are present.

Forestland

With permafrost:
Principal tree species are: black spruce and white spruce
Common understory plants are: Labrador tea ledum, black crowberry, lowbush cranberry, bog blueberry, and moss
Mean site index and yields: not estimated—the presence of permafrost and the associated perched water table result in stunted growth and low site productivity

General management considerations:
*Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost, lowering of the water table, and increased site productivity.

When thawed:
Principal tree species are: white spruce and quaking aspen
Common understory plants are: soapberry, tall willow, red bearberry, Labrador tea ledum, pumpkinberry, and moss
Estimated site index (100 year site curve) for stated species: white spruce—65
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—600 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2100 cubic feet/acre *(Farr 1967)*

General management considerations:
*Productivity of maturing stands may decline significantly as permafrost and the associated perched water table rise within the soil profile.
*Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*Logging roads may require ballast.
*Adequately designed drainage systems reduce the risk of concentrated flow erosion on roadways.
*Because cold soil temperatures restrict roots, trees are subject to windthrow.
*If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked stand of trees.
*Trees suitable for planting are white spruce.

Suitable management practices:
*Use conventional equipment in harvesting, but limit its use when the soil is wet.
*Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

With permafrost:
General management considerations:
*Excavation is hampered by permafrost.
*Excavation can expose material that is highly susceptible to wind erosion.

*Excavation increases the risk of water erosion.
*Frost action limits construction of access roads, driveways, and buildings.
*Septic tank absorption fields may function poorly because of wetness and the limited depth to permafrost, which restrict the movement and infiltration of effluent.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.
*Construct buildings on thick gravel pads to reduce subsidence caused by the melting of permafrost.
*Leave the vegetation and organic mat intact where it is desirable to maintain the present level of permafrost.
*Underlay roads with gravel to minimize frost action.
*Clearing large areas with obvious surface drainage outlets results in the eventual subsidence of the permafrost and water table to below 60 inches (152 cm).

When thawed:
General management considerations:
*Excavation can expose material that is highly susceptible to wind erosion.
*Frost action limits construction of access roads, driveways, and buildings.
*This unit is a good source of roadfill.
*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.
*Depressional areas that comprise up to 10 percent of this unit remain wet after clearing.
*Septic tank absorption fields may function poorly because of the restricted permeability of the soil.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Provide drainage to reduce wetness if roads and buildings are to be constructed in depressional areas.
*Consider the depth to which annual frosts penetrate when designing footings and road bases.
*Increase the size of septic absorption areas to compensate for the restricted permeability.
*Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Conduct on-site investigations to determine if massive ice features are present.
*Underlay roads with gravel to minimize frost action.

470—Tolsona peat, 7 to 12 percent slopes

Composition

Tolsona peat and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Tolsona Soil

Positions on landscape: till plains
Slope range: 7 to 12 percent
Slope features: plane or concave
Organic mat on surface: 8 to 13 inches (20 to 33 cm) thick
Native vegetation: black and white spruce, low and dwarf shrubs, scattered herbs, and moss

Typical profile:
*8 inches to 0 (20 cm to 0)—dark reddish brown peat and black mucky peat consisting of fibrous and partially decomposed roots, moss, and twigs
*0 to 3 inches (0 to 8 cm)—dark brown and black mucky silt loam
*3 to 24 inches (8 to 61 cm)—dark grayish brown and olive gray gravelly loam and gravelly sandy loam
*24 to 34 inches (61 to 86 cm)—perennially frozen, olive gray gravelly sandy loam

Drainage class: very poorly drained or poorly drained
Permeability: in the organic mat—moderately rapid; in the mineral soil above the permafrost—moderate; in the permafrost—impermeable
Available water capacity: including organic mat—moderate
Root restricting feature: permafrost
Depth to permafrost: 14 to 26 inches (36 to 66 cm) below the surface of the mineral soil
Depth to contrasting till material: 1 to 8 inches (3 to 20 cm)
Runoff: slow
Depth to perched water table: 12 to 24 inches (30 to 61 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in similar positions that lack thick organic mats, permafrost, and the associated perched water table within 40 inches (100 cm)
*soils in muskegs that have over 16 inches (40 cm) of organic material overlying mineral soil

***soils in similar positions with sandy, clayey, or very gravelly textures within 40 inches (100 cm) of the mineral surface**
***soils with slopes of less than 7 percent or greater than 12 percent**

Major Uses

Current uses: wildlife habitat
Potential uses: forestland, homesteads, hayland and pastureland, and roadfill

Major Management Factors

Soil-related factors: wind erosion, water erosion, slopes, depth to permafrost, frost heaving, load supporting capacity, restricted permeability, thermokarst, and depth to perched water table
Elevation: 1300 to 2200 feet (335 to 427 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—60 to 70 days (28 degree base temperature)

Hayland and Pastureland

With permafrost:
General management considerations:
*****Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost and subsequent lowering of the water table.
*****Differential subsidence may occur where massive ice features are present.

Suitable management practices:
*****Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.
*****Leave strips of trees as windbreaks when clearing.

When thawed:
General management considerations:
*****Due to frequent mid-summer frosts and a relatively short frost-free season, suitable crops for planting include hay, and permanent pasture.
*****Additional drainage may be necessary in areas where natural drainage outlets are absent.
*****Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.
*****Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*****Hay crops respond well to fertilizer if precipitation is adequate.
*****Occasional boulders on the surface may present a hazard to machinery.

Suitable management practices:
*****Use conservation tillage to conserve moisture.
*****Maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*****Seed to permanent hay or pasture, cultivate and seed on the contour or across the slope, and maintain crop residue on or near the surface to reduce the risk of water erosion.
*****Conduct on-site investigations to determine if massive ice features are present.

Forestland

With permafrost:
Principal tree species are: black spruce and white spruce
Common understory plants are: Labrador tea ledum, black crowberry, lowbush cranberry, bog blueberry, and moss
Mean site index and yields: not estimated—the presence of permafrost and the associated perched water table result in stunted growth and low site productivity

General management considerations:
*****Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost, lowering of the water table, and increased site productivity.

When thawed:
Principal tree species are: white spruce and quaking aspen
Common understory plants are: soapberry, tall willow, red bearberry, Labrador tea ledum, pumpkinberry, and moss
Estimated site index (100 year site curve) for stated species: white spruce—65
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—600 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2100 cubic feet/acre *(Farr 1967)*

General management considerations:
*****Productivity of maturing stands may decline significantly as permafrost and the associated perched water table rise within the soil profile.

*Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*Logging roads may require ballast.
*Because cold soil temperatures restrict roots, trees are subject to windthrow.
*If seed trees are in the stand, reforestation occurs naturally in cutover areas.
*Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked stand of trees.
*Trees suitable for planting are white spruce.

Suitable management practices:
*Use conventional equipment in harvesting, but limit its use when the soil is wet.
*Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

With permafrost:
General management considerations:
*Excavation is hampered by permafrost.
*Excavation can expose material that is highly susceptible to wind erosion.
*Excavation increases the risk of water erosion.
*Frost action limits construction of access roads, driveways, and buildings.
*Road cutbanks are subject to slumping.
*Local roads may require a special base to prevent permafrost damage.
*Septic tank absorption fields may function poorly because of wetness and the limited depth to permafrost, which restrict the movement and infiltration of effluent.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.
*Design and construct buildings to compensate for the steepness of slope.
*Underlay roads with gravel to minimize frost action.
*Establish gently sloping grades and revegetate as soon as possible to reduce the risk of slumping.
*Construct buildings on thick gravel pads to reduce subsidence caused by the melting of permafrost.
*Leave the vegetation and organic mat intact where it is desirable to maintain the present level of permafrost.
*Clearing large areas with obvious surface drainage outlets results in the eventual subsidence of the permafrost and water table to below 60 inches (152 cm).

When thawed:
General management considerations:
*Excavation can expose material that is highly susceptible to wind erosion.
*Excavation increases the risk of water erosion.
*Frost action limits construction of access roads, driveways, and buildings.
*This unit is a good source of roadfill.
*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.
*Septic tank absorption fields may function poorly because of the restricted permeability of the soil.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Consider the depth to which annual frosts penetrate when designing footings and road bases.
*Design and construct buildings and access roads to compensate for steepness of slope.
*Increase the size of septic absorption areas to compensate for the restricted permeability.
*Install septic absorption lines in adjacent areas that are more nearly level.
*Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Conduct on-site investigations to determine if massive ice features are present.
*Underlay roads with gravel to minimize frost action.

471—Tsana silt loam, 0 to 7 percent slopes

Composition

Tsana silt loam and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Tsana Soil

Positions on landscape: till plains
Slope range: 0 to 7 percent
Slope features: plane or convex
Organic mat on surface: 1 to 5 inches (2 to 13 cm) thick
Native vegetation: white spruce, quaking aspen, tall willow, low and dwarf shrubs, scattered herbs, and moss

Typical profile:
*0 to 7 inches (0 to 18 cm)—black and dark brown silt loam
*7 to 60 inches (18 to 152 cm)—dark grayish brown and olive gray gravelly sandy loam

Depth class: very deep (more than 60 inches or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: moderate
Depth to contrasting till material: 4 to 8 inches (10 to 20 cm) below the surface of the mineral soil
Runoff: slow
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in similar positions and muskegs with thick organic mats, saturated conditions, and permafrost within 40 inches (100 cm)
*soils in similar positions that have very cobbly, very gravelly, or sandy surface textures
*soils with slopes greater than 7 percent

Major Uses

Current uses: homesteads and wildlife habitat
Potential uses: forestland, hayland and pastureland, and roadfill

Major Management Factors

Soil-related factors: wind erosion, water erosion, frost heaving, restricted permeability, and low fertility
Elevation: 1300 to 2200 feet (396 to 670 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*frost-free period—60 to 70 days (28 degree base temperature)

Hayland and Pastureland

General management considerations:
*Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.
*Due to frequent mid-summer frosts and a relatively short frost-free season, the suitable crops for planting are hay, permanent pasture, and grain crops harvested as hay.
*Hay crops respond well to fertilizer if precipitation is adequate.
*Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*Occasional boulders and cobbles may present a hazard to machinery.
*Small depressional areas that comprise up to 10 percent of this unit remain wet for extended periods in the spring and may delay cultivation.

Suitable management practices:
*Use conservation tillage and farm on the contour to conserve moisture.
*Use conservation tillage to maintain or improve soil fertility.
*Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*Cultivate on the contour or across the slope to reduce the risk of water erosion.
*Use shallow cuts when land smoothing to avoid exposing areas of cobbly and/or gravelly material.
*Leave strips of trees as windbreaks when clearing.
*Conduct on-site investigations to determine if massive ice features are present.

Forestland

Principal tree species are: white spruce and quaking aspen
Common understory plants are: lowbush cranberry, pumpkinberry, lupine, moss, prickly rose, and twinflower
Mean site index (100 year site curve) for stated species (and source): white spruce—65 *(Farr 1967),* based on a sample of 25 trees in 5 plots
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—600 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2100 cubic feet/acre *(Farr 1967)*

General management considerations:
*Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*Productivity of maturing stands may decline significantly as permafrost and associated water table rise in the soil profile.
*Adequately designed drainage systems reduce the risk of concentrated flow erosion on roadways.

*Because cold soil temperatures and shallow soil depth restrict roots, trees are subject to windthrow.
*Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*Trees suitable for planting are white spruce.

Suitable management practices:
*Use conventional equipment in harvesting, but limit its use when the soil is wet.
*Seed cuts and fills and stabilize cuts with grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

General management considerations:
*Excavation can expose soil material that is highly susceptible to wind erosion.
*Excavation increases the risk of water erosion.
*This unit is a good source of roadfill.
*Frost action limits construction of access roads, driveways, and buildings.
*Septic tank absorption fields may function poorly because of the restricted permeability of the soil.
*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Consider the depth to which annual frosts penetrate in designing footings and road bases.
*Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Increase the size of septic absorption areas to compensate for the restricted permeability.
*Underlay roads with gravel to minimize frost action.
*Conduct on-site investigations to determine if massive ice features are present.

472—Tsana silt loam, thin surface, 0 to 7 percent slopes

Composition

Tsana silt loam, thin surface, and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Tsana Soil

Positions on landscape: till plains
Microtopography: depressions between drumlins and moraines
Slope range: 0 to 7 percent
Slope features: plane or concave
Organic mat on surface: 1 to 5 inches (2 to 13 cm) thick
Native vegetation: white spruce, quaking aspen, tall willow, low and dwarf shrubs, scattered herbs, and moss

Typical profile:
*0 to 3 inches (0 to 8 cm)—black and dark brown silt loam
*3 to 60 inches (8 to 152 cm)—dark grayish brown and olive gray fine sandy loam and sandy loam
Depth class: very deep (more than 60 inches or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: moderate
Depth to contrasting till material: 1 to 4 inches (3 to 10 cm) below the surface of the mineral soil
Runoff: slow
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*soils in similar positions and muskegs with thick organic mats, saturated conditions, and permafrost within 40 inches (100 cm)
*soils in similar positions that have very cobbly, very gravelly, or sandy surface textures
*soils with slopes greater than 7 percent

Major Uses

Current uses: homesteads and wildlife habitat
Potential uses: forestland, hayland and pastureland, and roadfill

Major Management Factors

Soil-related factors: cobbles, wind erosion, water erosion, frost heaving, restricted permeability, and low fertility
Elevation: 1300 to 2200 feet (396 to 670 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*frost-free period—60 to 70 days (28 degree base temperature)

Hayland and Pastureland

General management considerations:

*Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.
*Due to frequent mid-summer frosts and a relatively short frost-free season, the suitable crops for planting are hay, permanent pasture, and grain crops harvested as hay.
*Hay crops respond well to fertilizer if precipitation is adequate.
*Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*The large number of cobbles within the plow depth limits fieldwork.
*Small depressional areas that comprise up to 10 percent of this unit remain wet for extended periods in the spring and may delay cultivation.

Suitable management practices:

*Use conservation tillage and farm on the contour to conserve moisture.
*Use conservation tillage to maintain or improve soil fertility.
*Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*Cultivate on the contour or across the slope to reduce the risk of water erosion.
*Leave strips of trees as windbreaks when clearing.
*Conduct on-site investigations to determine if massive ice features are present.

Forestland

Principal tree species are: white spruce and quaking aspen
Common understory plants are: lowbush cranberry, pumpkinberry, lupine, moss, prickly rose, and twinflower
Mean site index (100 year site curve) for stated species (and source): white spruce—65 *(Farr 1967),* based on a sample of 25 trees in 5 plots
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—600 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2100 cubic feet/acre *(Farr 1967)*

General management considerations:

*Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*Productivity of maturing stands may decline significantly as permafrost and associated water table rise in the soil profile.
*Adequately designed drainage systems reduce the risk of concentrated flow erosion on roadways.
*Because cold soil temperatures and gravelly material restrict roots, trees are subject to windthrow.
*Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*Trees suitable for planting are white spruce.

Suitable management practices:

*Use conventional equipment in harvesting, but limit its use when the soil is wet.
*Seed cuts and fills and stabilize cuts with grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

General management considerations:

*Excavation can expose soil material that is highly susceptible to wind erosion.
*Excavation increases the risk of water erosion.
*This unit is a good source of roadfill.
*Frost action limits construction of access roads, driveways, and buildings.
*Septic tank absorption fields may function poorly because of the restricted permeability of the soil.
*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.

Suitable management practices:

*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Consider the depth to which annual frosts penetrate in designing footings and road bases.
*Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Increase the size of septic absorption areas to compensate for the restricted permeability.
*Underlay roads with gravel to minimize frost action.
*Conduct on-site investigations to determine if massive ice features are present.

473—Tsana silt loam, thin surface, 7 to 20 percent slopes

Composition

Tsana silt loam, thin surface, and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Tsana Soil

Positions on landscape: till plains and hills
Slope range: 7 to 20 percent
Slope features: plane or convex
Organic mat on surface: 1 to 5 inches (2 to 13 cm) thick
Native vegetation: white spruce, quaking aspen, tall willow, low and dwarf shrubs, scattered herbs, and moss
Typical profile:
*****0 to 3 inches (0 to 8 cm)—black and dark brown silt loam
*****3 to 60 inches (8 to 152 cm)—dark grayish brown and olive gray fine sandy loam and sandy loam

Depth class: very deep (more than 60 inches or 152 cm)
Drainage class: well drained
Permeability: moderate
Available water capacity: moderate
Depth to contrasting till material: 1 to 4 inches (3 to 10 cm) below the surface of the mineral soil
Runoff: medium
Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in similar positions and muskegs with thick organic mats, saturated conditions, and permafrost within 40 inches (100 cm)
*****soils in similar positions that have very cobbly, very gravelly, or sandy surface textures
*****soils with slopes of less than 7 percent or greater than 12 percent

Major Uses

Current uses: homesteads and wildlife habitat
Potential uses: forestland, hayland and pastureland, and roadfill

Major Management Factors

Soil-related factors: cobbles, wind erosion, water erosion, slope, frost heaving, restricted permeability, and low fertility
Elevation: 1300 to 2200 feet (396 to 670 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—60 to 70 days (28 degree base temperature)

Hayland and Pastureland

General management considerations:
*Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.
*****Due to frequent mid-summer frosts and a relatively short frost-free season, the suitable crops for planting are hay, permanent pasture, and grain crops harvested as hay.
*****Hay crops respond well to fertilizer if precipitation is adequate.
*****Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*****The large number of cobbles within the plow depth limits fieldwork.
*****Occasional boulders may present a hazard to machinery.

Suitable management practices:
*****Use conservation tillage to conserve moisture.
*****Seed to permanent hay or pasture, cultivate and seed on the contour or across the slope, and leave native vegetation intact on steeper areas of this unit to reduce the risk of water erosion.
*****Maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*****Leave strips of trees as windbreaks when clearing.
*****Conduct on-site investigations to determine if massive ice features are present.

Forestland

Principal tree species are: white spruce and quaking aspen
Common understory plants are: soapberry, tall willow, red bearberry, lowbush cranberry, pumpkinberry, and moss

Mean site index (100 year site curve) for stated species (and source): white spruce—65 (*Farr 1967*), based on a sample of 25 trees in 5 plots
Estimated average total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—600 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2100 cubic feet/acre *(Farr 1967)*

General management considerations:
*****Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*****Productivity of maturing stands may decline significantly as permafrost and associated water table rise in the soil profile.
*****Adequately designed drainage systems reduce the risk of concentrated flow erosion on roadways.
*****Because cold soil temperatures restrict roots, trees are subject to windthrow.
*****Plant competition delays natural regeneration but does not prevent the eventual development of a fully stocked, normal stand of trees.
*****Trees suitable for planting are white spruce.

Suitable management practices:
*****Use conventional equipment in harvesting, but limit its use when the soil is wet.
*****Seed cuts and fills and stabilize cuts with grass straw mulch to reduce the risk of erosion.
*****Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Building Site Development

General management considerations:
*****Excavation can expose soil material that is highly susceptible to wind erosion.
*****Excavation increases the risk of water erosion.
*****Road cutbanks are subject to slumping.
*****This unit is a good source of roadfill.
*****Frost action limits construction of access roads, driveways, and buildings.
*****Septic tank absorption fields may function poorly because of the restricted permeability of the soil.
*****Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.

Suitable management practices:
*****Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*****Consider the depth to which annual frosts penetrate in designing footings and road bases.
*****Design and construct buildings and access roads to compensate for steepness of slope.
*****Locate roads in more gently sloping areas, and design drainage systems to minimize the risk of slumping.
*****Stockpile topsoil and use it to reclaim areas disturbed during construction.
*****Increase the size of septic absorption areas to compensate for the restricted permeability.
*****Install septic absorption lines in adjacent areas that are more nearly level.
*****Underlay roads with gravel to minimize frost action.
*****Conduct on-site investigations to determine if massive ice features are present.

474—Tolsona-Klanelneechena complex, 0 to 7 percent slopes

Composition

Tolsona peat and similar inclusions: 50 percent
Klanelneechena peat and similar inclusions: 35 percent
Contrasting inclusions: 15 percent

Characteristics of Tolsona Soil

Positions on landscape: till plains
Slope range: 0 to 7 percent
Slope features: plane or concave
Organic mat on surface: 8 to 13 inches (20 to 33 cm) thick
Native vegetation: black and white spruce, low and dwarf shrubs, scattered herbs, and moss

Typical profile:
*****9 inches to 0 (23 cm to 0)—dark reddish brown peat and black mucky peat consisting of fibrous and partially decomposed roots, moss, and twigs
*****0 to 2 inches (0 to 5 cm)—black mucky silt loam
*****2 to 27 inches (5 to 69 cm)—dark grayish brown loam
*****27 to 37 inches (69 to 94 cm)—perennially frozen, dark grayish brown gravelly loam

Drainage class: very poorly drained or poorly drained
Permeability: in the organic mat—moderately rapid; in the mineral soil above the permafrost—moderate; in the permafrost—impermeable
Available water capacity: including organic mat—low
Root restricting feature: permafrost
Depth to permafrost: 14 to 26 inches (36 to 66 cm) below the surface of the mineral soil
Depth to contrasting till material: 1 to 4 inches (2 to 10 cm)
Runoff: slow
Depth to perched water table: 12 to 24 inches (30 to 61 cm) below the surface of the organic mat

Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Characteristics of Klanelneechena Soil

Positions on landscape: till plains
Slope range: 0 to 7 percent
Slope features: plane or concave
Organic mat on surface: 8 to 13 inches (20 to 33 cm) thick
Native vegetation: dwarf black and white spruce, low and dwarf shrubs, herbs, and moss

Typical profile:
*****11 inches to 0 (28 cm to 0)—black peat and mucky peat consisting of fibrous and partially decomposed roots, moss, and twigs
*****0 to 2 inches (0 to 5 cm)— very dark brown mucky silt loam
*****2 to 18 inches (5 to 46 cm)—very dark grayish brown sand
*****18 to 28 inches (46 to 71 cm)—perennially frozen, very dark grayish brown sand

Drainage class: very poorly drained or poorly drained
Permeability: in the organic mat—moderately rapid; in the silty loess mantle—moderate; in the sandy material—rapid; in the permafrost—impermeable
Available water capacity: including organic mat—low
Root restricting feature: permafrost
Depth to permafrost: 15 to 34 inches (38 to 86 cm) below the surface of the mineral soil
Depth to contrasting sandy material: 1 to 3 inches (2 to 8 cm)
Runoff: slow
Depth to perched water table: 7 to 15 inches (18 to 38 cm) below the surface of the organic mat
Hazard of erosion: by water—slight if the organic mat is not removed, slight if the organic mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

*****soils in similar positions that lack thick organic mats, permafrost, and the associated perched water table within 40 inches (100 cm)
*****soils in muskegs that have over 16 inches (40 cm) of organic material overlying mineral soil and permafrost
*****soils in similar positions with very gravelly textures within 40 inches (100 cm) of the mineral surface
*****soils with slopes greater than 2 percent

Major Uses

Current uses: wildlife habitat
Potential uses: homesteads, hayland and pastureland, roadfill, and forestland

Major Management Factors

Soil-related factors: available water capacity, depth to permafrost, wind erosion, water erosion, frost heaving, depth to perched water table, thermokarst, and permeability
Elevation: 1400 to 2200 feet (427 to 670 m)
Climatic factors (average annual):
*****precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*****air temperature—26 °F (-3 °C)
*****frost-free period—60 to 70 days (28 degree base temperature)

Hayland and Pastureland

Tolsona soils with permafrost:
General management considerations:
*****Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost and subsequent lowering of the water table.
*****Differential subsidence may occur where massive ice features are present.

Suitable management practices:
*****Leave strips of trees as windbreaks when clearing.
*****Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.

Tolsona soils when thawed:
General management considerations:
*****Due to frequent mid-summer frosts and a relatively short frost-free season, the suitable crops for planting are hay, permanent pasture, and grain crops harvested as hay.
*****Small depressional areas that comprise up to 10 percent of this unit remain wet for extended periods in the spring and may delay cultivation.
*****Additional drainage may be necessary in areas where natural drainage outlets are absent.
*****Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.
*****Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.

*Hay crops respond well to fertilizer if precipitation is adequate.
*Occasional boulders and cobbles on the surface may present a hazard to machinery.

Suitable management practices:
*Use conservation tillage to conserve moisture and maintain or improve soil fertility.
*Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*Seed to permanent hay or pasture and cultivate on the contour or across the slope to reduce the risk of water erosion.
*Conduct on-site investigations to determine if massive ice features are present.

Klanelneechena soils with permafrost:
General management considerations:
*Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost and subsequent lowering of the water table.
*Differential subsidence may occur where massive ice features are present.

Suitable management practices:
*Leave strips of trees as windbreaks when clearing.
*Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.

Klanelneechena soils when thawed:
General management considerations:
*Due to frequent mid-summer frosts and a relatively short frost-free season, the suitable crops for planting are hay, permanent pasture, and grain crops harvested as hay.
*Small depressional areas that comprise up to 10 percent of this unit remain wet for extended periods in the spring and may delay cultivation.
*Additional drainage may be necessary in areas where natural drainage outlets are absent.
*Differential subsidence may occur after clearing in areas where massive ice features are present. Continued land smoothing and maintenance may be required.
*The high content of sand reduces the amount of moisture available to plants.
*Limited late spring precipitation and frequent mid-summer frosts may reduce crop yields.
*Hay crops respond well to fertilizer if precipitation is adequate.
*Occasional boulders and cobbles on the surface may present a hazard to machinery.

Suitable management practices:
*Use conservation tillage to conserve moisture and maintain or improve soil fertility.
*Plant crops in narrow strips at right angles to the prevailing wind, maintain crop residue on the surface, use conservation tillage, and limit the width of strips of unprotected soils to reduce the risk of wind erosion.
*Cultivate on the contour or across the slope to reduce the risk of water erosion.
*Conduct on-site investigations to determine if massive ice features are present.

Forestland

Tolsona soil with permafrost:
Principal tree species are: black spruce and white spruce
Common understory plants are: Labrador tea ledum, red bearberry, lowbush cranberry, bog blueberry, and moss
Mean site index and yields: not estimated—the presence of permafrost and the associated perched water table result in stunted growth and low site productivity

General management considerations:
*Clearing large areas with obvious surface drainage outlets results in thawing of the permafrost, lowering of the water table, and increased site productivity.

Tolsona soil when thawed:
Principal tree species are: white spruce and quaking aspen
Common understory plants are: soapberry, tall willow, red bearberry, Labrador tea ledum, pumpkinberry, and moss
Estimated site index (100 year site curve) for stated species: white spruce—65
Estimated total production for stated species (and source) from a stand 100 years old: white spruce trees greater than 8.5 inches diameter at breast height—600 cubic feet/acre; trees greater than 4.5 inches diameter at breast height—2100 cubic feet/acre *(Farr 1967)*

General management considerations:
*Productivity of maturing stands may decline significantly as permafrost and the associated perched water table rise in the soil profile.
*Using wheeled and tracked equipment when the soil is wet produces ruts and increases compaction.
*Logging roads may require ballast.
*Because cold soil temperatures restrict roots, trees are subject to windthrow.

*Trees suitable for planting are white spruce.

Suitable management practices:
*Use conventional equipment in harvesting, but limit its use when the soil is wet.
*Seed cuts and fills and stabilize with grass straw mulch to reduce the risk of erosion.
*Thin trees before they reach commerical size and selectively cut mature trees to improve stands.

Klanelneechena soil with permafrost:
Site index not estimated.

General management considerations:
*The presence of permafrost and the associated perched water table result in stunted tree growth and low site productivity.

Suitable management practices:
*Clearing large areas with obvious surface drainage outlets results in thawing of permafrost and subsequent lowering of the water table.

Building Site Development

Tolsona soil with permafrost:
General management considerations:
*Excavation is hampered by permafrost.
*Excavation can expose material that is highly susceptible to wind erosion.
*Excavation increases the risk of water erosion.

*Frost action limits construction of access roads, driveways, and buildings.
*Septic tank absorption fields may function poorly because of wetness and the limited depth to permafrost, which restrict the movement and infiltration of effluent.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.
*Construct buildings and roads on thick gravel pads to offset subsidence caused by the melting of permafrost.
*Leave the vegetation and organic mat intact where it is desirable to maintain the present level of permafrost.
*Clearing large areas with obvious surface drainage outlets results in the eventual subsidence of the permafrost and water table to below 60 inches (152 cm).

Tolsona soil when thawed:
General management considerations:
*Excavation can expose material that is highly susceptible to wind erosion.
*Excavation increases the risk of water erosion.
*Frost action limits construction of access roads, driveways, and buildings.
*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.
*Septic tank absorption fields may function poorly because of the restricted permeability of the soil.
*This unit is a good source of roadfill.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Consider the depth to which annual frosts penetrate when designing footings and road bases.
*Increase the size of septic absorption areas to compensate for the restricted permeability.
*Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Conduct on-site investigations to determine if massive ice features are present.
*Underlay roads with gravel to minimize frost action.

Klanelneechena soil with permafrost:
General management considerations:
*Excavation is hampered by permafrost.

*Excavation can expose material that is highly susceptible to wind erosion.
*Excavation increases the risk of water erosion.
*Local roads may require a special base to prevent permafrost damage.
*Cutbanks are not stable and are subject to caving.
*Septic tank absorption fields may function poorly because of wetness and the limited depth to permafrost, which restrict the movement and infiltration of effluent.

Suitable management practices:
*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Conduct on-site investigations to determine the nature and ice content of frozen substrata materials.
*Construct buildings on thick gravel pads to reduce subsidence caused by the melting of permafrost.
*Leave the vegetation and organic mat intact where it is desirable to maintain the present level of permafrost.
*Underlay roads with gravel to minimize frost action.

*Clearing large areas with obvious surface drainage outlets results in the eventual subsidence of the permafrost and water table to below 60 inches (152 cm).

Klanelneechena soil when thawed:

General management considerations:

*Depressional areas that comprise up to 10 percent of this unit remain wet after clearing.
*Excavation can expose material that is highly susceptible to wind erosion.
*Excavation increases the risk of water erosion.
*Differential subsidence may occur in areas where massive ice features are present and may continue for several years following excavation.
*Cutbanks are not stable and are subject to caving.
*Septic tank absorption fields may function poorly in many areas because of wetness.

Suitable management practices:

*Revegetate disturbed areas at construction sites as soon as possible to reduce erosion hazard.
*Stockpile topsoil and use it to reclaim areas disturbed during construction.
*Establish gently sloping grades on cutbanks and excavations to reduce the risk of caving.
*Provide drainage to reduce wetness if roads and buildings are to be constructed in depressional areas.
*Conduct on-site investigations to determine if massive ice features are present.

475—Wrangell peat, 0 to 2 percent slopes

Composition

Wrangell peat and similar inclusions: 90 percent
Contrasting inclusions: 10 percent

Characteristics of Wrangell Soil

Positions on landscape: muskegs
Slope range: 0 to 2 percent
Slope features: plane or concave
Organic mat on surface: 18 to 33 inches (46 to 84 cm) thick
Native vegetation: low ericaceous shrubs and willows, sedges, moss, and stunted black spruce
Typical profile:
*0 to 4 inches (0 to 10 cm)—dark reddish brown peat consisting of undecomposed roots, sedges, and shrub fibers
*4 to 23 inches (10 to 58 cm)—dark reddish brown mucky peat consisting of decomposed root, sedge, and shrub fibers
*23 to 37 inches (58 to 94 cm)—dark greenish gray and olive gray silty clay
*37 to 47 inches (94 to 119 cm)—perennially frozen, olive gray silty clay

Drainage class: very poorly drained
Permeability: in the organic layers—moderately rapid; in the mineral soil—moderately slow; in the permafrost—impermeable
Available water capacity: very high
Root restricting feature: permafrost
Depth to permafrost: 14 to 38 inches (36 to 97 cm) below the surface of the mineral soil
Runoff: slow
Depth to perched water table: 0 to 8 inches (0 to 20 cm) below the surface of the organic mat
Hazard of erosion: by water—slight; by wind—slight
Hazard of flooding: none

Included Areas

*soils in convex positions that lack thick organic mats and water tables in the surface 40 inches (100 cm)
*water
*soils with slopes greater than 2 percent

Major Uses

Current uses: wildlife habitat

Major Management Factors

Soil-related factors: depth to water table
Elevation: 900 to 2100 feet (274 to 640 m)
Climatic factors (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
*frost-free period—60 to 90 days (28 degree base temperature)

Figures

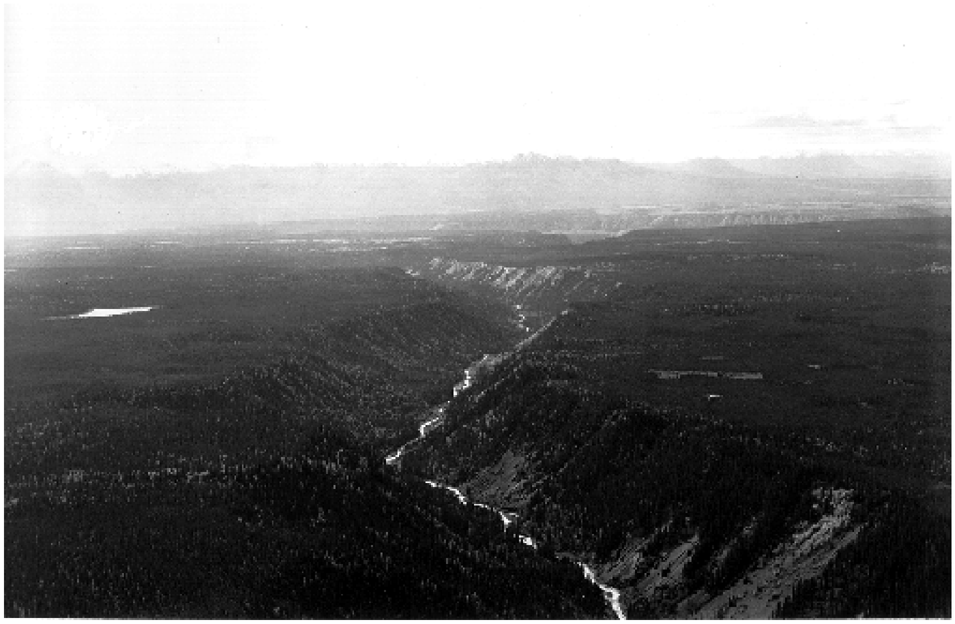

Figure 1—Broad lacustrine terraces with discontinuous shallow permafrost extend for several miles on each side of the Copper River. Soils include the very poorly drained, permafrost-rich Copper River, Klawasi, and Mendeltna soils; and the well drained Chitina, Kenny Lake, Gakona, and Chetaslina soils which lack permafrost.

Figure 2—Well drained Tebay and Chistochina soils occur on quaken aspen forested drumlins, represented by the light tonal areas. Very poorly and poorly drained, permafrost-rich Tolsona and Cryohemist soils occupy the intermingling forested and nonforested depressions between drumlins.

Figure 3—This photo illustrates the braided nature of the glacially influenced Copper River. Note the barren gravel bars and channels (riverwash) and the scattered islands of willow and alder shrub vegetation typical of Nizina frequently flooded soils.

Figure 4—Natural surface disturbance has resulted in melting of the permafrost and slumping.

Figure 5—Only about 30 percent of the soil survey area was accessible by road. Helicopters were the principle tool used for accessing a majority of the project area.

Figure 6—A power auger was a useful tool for sampling the frozen substratum materials of this Copper River soil.

Figure 7—These circular objects are slices from an ice core extracted from the substratum of a Cryochrept soil. Ice masses like this contain little soil material, and removal of the insulating organic mat by fire or other disturbance may result in melting and eventual slope failure or subsidence.

Figure 8—Small grains and hay are common crops grown on the Kenny Lake soils in the Kenny Lake area.

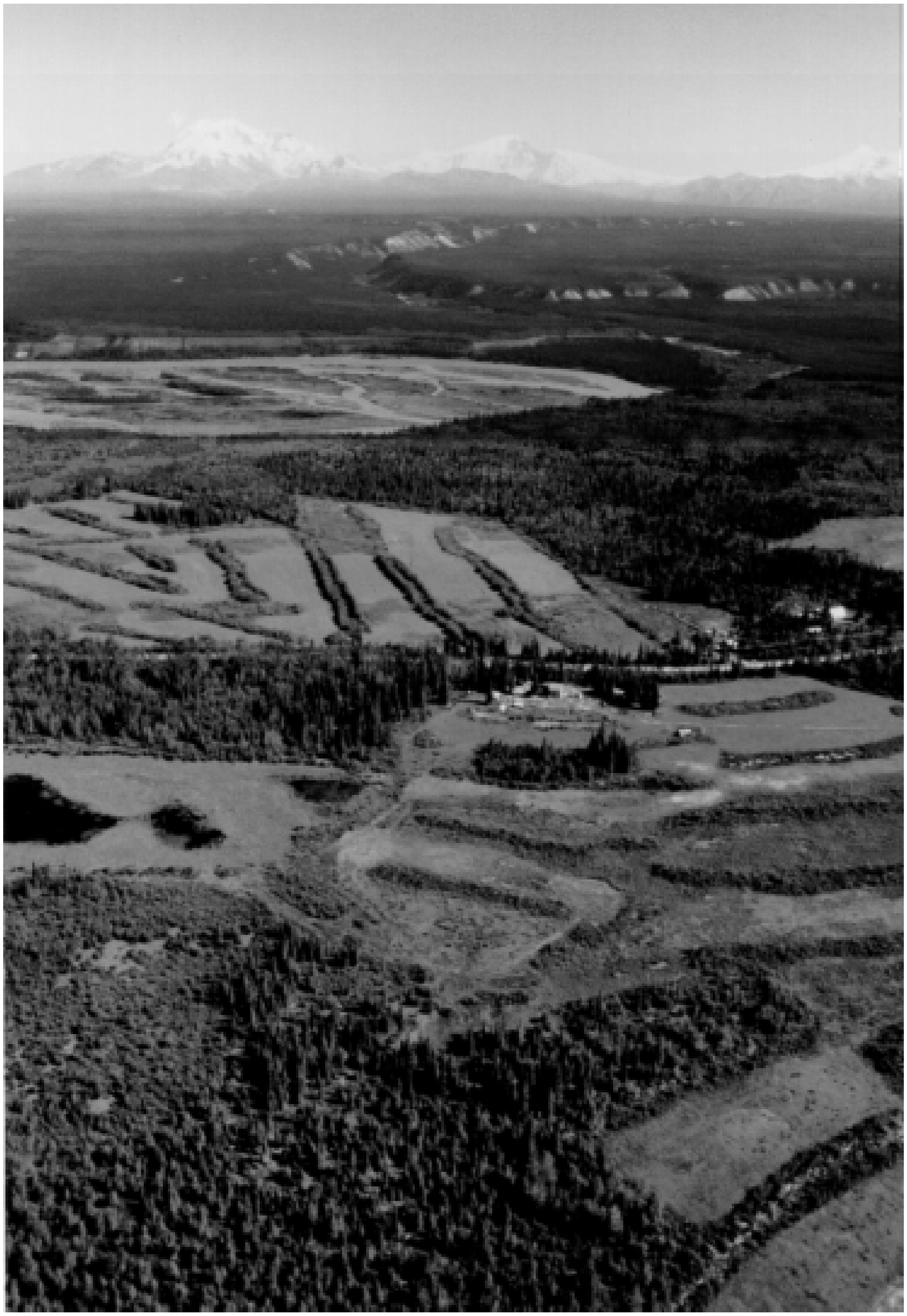

Figure 9—These fields, on Tonsina and Kenny Lake soils, were recently cleared, and the trees have been bulldozed into berm rows for eventual burning.

Figure 10—Vegetation on warm southerly exposures (right) includes shrubs and herbs, barren ground, and productive white spruce forest. Cool, northerly exposures (left) are dominated by black spruce with thick surface organic mats and shallow permafrost. These conditions are typical of map unit 424—Cryorthents and Cryochrepts, 30 to 70 percent slopes.

Figure 11—This fire mosaic illustrates the impact of fire on vegetation and soil patterns. Klawasi soils occur in the dark tonal areas, and have black spruce vegetation, thick moss mats, and shallow permafrost. The light tonal areas are dominated by willow vegetation and Gakona soils which have thin organic mats, are well drained, and lack shallow permafrost.

Figure 12—Stream terraces along the Copper River formed as the river down cut through alluvial deposits, forming a series of elevated gravelly terraces. Gulkana soils are the principle soils on stream terraces.

Figure 13—Cryofibrist soils are thick, fibrous organic soils that occur along the margins of ponds and lakes. These soils lack shallow permafrost and provide excellent habitat for waterfowl and moose.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment, and to help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. Field experience and data collected on soil properties, such as erosion, droughtimess, flooding, and other factors that affect various soil uses and management and performance, are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops, hay, pasture and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems; as parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil; and to identify areas where bedrock, wetness, permafrost, or very firm soil layers can cause difficulty in excavation. Health officials, highway officials, engineers, and others may find this survey useful in planning the safe disposal of wastes and locating sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

Prepared by Allen Koester, former District Conservationist, Natural Resources Conservation Service, Palmer, Alaska

Crops and Soils

In 1984, the Copper River Area had 1,400 acres in crops, hayland, and pasture. Of this, about 50 acres were in vegetables and potatoes, 365 acres in barley and oats, and the balance in hay. Another 500 acres of cropland was idle and growing back to brush. The acreage in grain and hay has remained static or decreased slightly in the past 5 years. Rehabilitating old "grow back" homestead fields and clearing new land could increase crop acres.

The soils and climate best suited to small grains, hay, and cool season vegetables and potatoes occur below 1,500 feet elevation. Soils with shallow permafrost and the associated perched water tables are not suitable for cultivation unless cleared. Removal of the forest canopy and organic mat results in the eventual subsidence of the permafrost. Subsidence of the water table follows in areas where surface drainage outlets are present. Generally, the best soils to be cleared and developed or reclaimed are the Copper River, Chitina, Kenny Lake, Tonsina, Klawasi, Gakona and Gulkana soils on slopes of 12 percent or less. Soils above 1,500 feet elevation and on slopes of 12 to 20 percent are best suited to permanent pasture and hay. The best soils at higher elevations to be cleared and developed or reclaimed are the Klawasi, Gakona, Mendeltna, and Chetaslina soils.

Undeveloped soils with a potential for agricultural production make up about 80,000 acres. Large blocks of Copper River, Chitina, Kenny Lake, Tolsona and Klawasi soils occur east and northeast of Kenny Lake. A large block of Copper River, Chitina, Kenny Lake and Tolsona soils occurs on the east side of the Copper River across from Copper Center, extending southeast to the lower Tonsina area. At the present time, however, there is no access to this area. Small areas of Gulkana soils occur on river terraces in the Copper Center and Glennallen areas.

Crop fertilizer requirements are high on all agricultural soils if optimum yields are desired. Newly cleared soils require large amounts of nitrogen to help soil micro-organisms decompose the woody residues left from clearing.

Moisture for seed germination is often limited at planting time. Winter snow melts and runs off before infiltrating into the soil because the ground is still frozen. Thus, the new crop must start growing on only the moisture that was in the ground at freeze-up the previous fall. Site preparation for spring crops should be kept to a minimum so that soil moisture is not lost. Summer rains usually start in mid- to late June. Irrigation of the newly planted crop would often be beneficial, however, there is not a reliable source of irrigation water from lakes or ground water.

The crops currently being grown in the Kenny Lake area include barley, oats, spring and winter wheat, hay, and vegetables including potatoes (Figure 8). Small grains, except for spring wheat, mature at least eight years out of ten but require drying before storage. Spring wheat will not consistently mature. The first crop of hay is cut at the end of June or early July. In at least half the years a second crop of hay can be made in late August or September. Vegetables (cole crops) mature every year. Potatoes will mature every year, however, about three out of 10 years the yield will be reduced because of frosts occurring in August or early September.

Wind and water easily erode all of the soils with agricultural potential; therefore, conservation practices must be used to protect the land as it is developed and farmed. Appropriate practices include developing or planting windbreaks, using crop rotations, and planting to perennial grass. Contouring, or planting rows across the slope, is recommended for vegetables and potatoes. Conservation tillage practices, which leave residues on the surface, also protect the soil from wind and water erosion. Because of the water erosion hazard, it is recommended that vegetables and potatoes be kept on slopes of less than 3 percent, grain on slopes of less than 8 percent, and pasture and hay on slopes of less than 12 percent. Slopes over 12 percent usually should not be cleared and developed because of the very high erosion hazard of silt loam soils.

Level ground can have a surface drainage problem in the spring due to run-off water collecting in depressions. Field operations and planting may need to be delayed while these areas drain and dry out.

Further information on adapted crop varieties, crop production, and fertilizer recommendations are available from the Alaska Cooperative Extension or Natural Resources Conservation Service.

Land Clearing

Several methods can be used to clear land. On large acreages, the vegetation can be knocked down by “chaining” with a heavy chain pulled between two bulldozers, stacked into berm rows, and burned (Figure 9). On smaller acreages, the vegetation may be walked down with a bulldozer, stacked into berm rows, and burned, or simply be bulldozed into berm rows and burned. If economically feasible, saw logs and firewood should be salvaged and used. Clearing operations should be done after freeze up in the fall and during winter and early spring. Initial tillage or “breaking” of the newly cleared land is usually done with a plow or heavy disc. A root rake may then be used to windrow the roots and sticks or they may be picked up by hand.

The Copper River and Klawasi soils are permafrost soils. Large acreages of these soils with surface drainage outlets should be cleared and developed in a block so that they will drain and be usable. Small acreages usually remain wet because they cannot drain adequately. In some areas, land may subside a few inches as ice lenses or ice wedges melt out. Copper River soils in the southeastern part of the survey area have a relatively high concentration of massive ice features. Thermokarst subsidence has been observed in recently cleared fields in the Strelna area, and special caution should be exercised when clearing Copper River soils in this part of the survey area.

Forest Productivity and Management

The wood products industry in the Copper River Area presently is limited to local cutting and processing of trees for house logs, posts and poles, firewood, and a small amount of rough cut green lumber. Extensive harvesting usually is associated with land clearing for agricultural or urban uses. During most land clearing operations, the wood resource is pushed down with heavy equipment, piled in berms, and burned. Alternate methods of land clearing, designed to fully utilize the wood resource, are not widely used at this time because of cost and time constraints.

Although demand for locally produced wood products will increase proportionate to anticipated population growth *(United States Department of Agriculture 1977)*, numerous biologic, economic, and political factors will limit the potential for an expanded wood products industry in the Copper River Area. Tree growth at the latitude and elevation of the basin is marginal in terms of quantity and quality. On most sites, forests tend to be open, slow growing, and of low volume; open grown trees tend to be limby, which restricts their commercial potential *(Hegg 1975)*. Further, repeated forest fires destroy much of the existing and potential volume, although fire management planning and suppression minimize such

losses. Access in the area presently is limited to main highways and roads and a few secondary roads. Commercial stands of white spruce on floodplains and river terraces probably cannot be harvested economically because of the dispersed distribution of the resource and the associated high cost of road building *(Hegg 1975)*. Fractionalized land ownership patterns *(Hegg 1975)* and uncertainties associated with land disposal and land use designation *(Samson et al. 1983)* suggest that the existing intensity of forest harvest and utilization is likely to continue.

All tree species growing in the area are of value for wood products. White spruce provides good lumber for general construction purposes, is preferred for house logs, can be used for posts and poles, and is suitable for firewood. Black spruce can be used for posts and poles and is of similar quality to white spruce for firewood. Both white and black spruce are abundant throughout the survey area. Aspen provides marginal quality lumber and is suitable for firewood, although of somewhat lower heat content than spruce. Aspen is readily available throughout the northern two-thirds of the survey area. Paper birch is satisfactory for lumber and is excellent for firewood, as its heat content far exceeds that of any other wood in the area. Paper birch is of relatively minor occurrence, in the southern one-third of the survey area. Balsam poplar is suitable for lumber and house logs but is poor firewood. Balsam poplar is of minor occurrence and is found primarily on floodplains and low stream terraces.

Forest Productivity

The major forest type, of commercial importance for lumber and building materials, is the white spruce type. The white spruce type consists of pure stands of white spruce as well as stands with a minor component of aspen, balsam poplar, and/or paper birch. Mature stands are composed of trees 65 to 80 feet (19 to 24 m) tall and 8 to 14 inches (19 to 35 cm) in diameter at breast height. The distribution of harvestable stands of the white spruce type is closely associated with floodplains and stream terraces.

Other forest types of potential commercial value are the white spruce-aspen, white spruce-balsam poplar, and white spruce-paper birch types. Over time, in these mixed types, the broadleaf trees gradually die out and are replaced by white spruce.

Table 6 summarizes white spruce productivity and estimated average yield for the forest soils based on data collected throughout the survey area. Productive stands of the white spruce type and the various mixed types were sampled in an effort to correlate tree growth and soils. Data were collected on well drained soils and thawed phases of permafrost soils on slopes of less than 12 percent. The potential productivity of white spruce on a soil is expressed as site index. Site index, estimated by taking height and age measurements on dominant and codominant trees within the stand, is expressed as the total height growth in feet at 100 years. Site index applies to well stocked, even-aged, unmanaged stands on a particular soil. The procedures and equation for estimating white spruce site index are given in Farr *(Farr 1967)*. Cubic-foot volume per acre is determined by converting site index into estimated yield using volume tables and equations given in Farr *(Farr 1967)*. Volumes given in Table 6 are estimates of potential volume only; actual stand volume will vary from stand to stand and must be measured in the field. *Productivity class* denotes potential productivity of the soils based on site index and mean annual increment; higher numbers indicate more productive soils. Productivity classes are used to group similar soils within a survey area as well as compare soils from different geographic areas.

White spruce productivity in the survey area is comparable to that observed elsewhere in Interior Alaska. In general, the most productive stands occur on well drained soils below 1,500 feet elevation. Survey data suggests a further separation of the forest soils based on soil physical and chemical characteristics. The substratum of Gulkana, Klutina, Nizina, and Pippin soils is sandy skeletal, porous, and well to somewhat excessively drained. Kenny Lake and Gakona have clayey substrata, strong granular structure, and are porous and well drained. All of these soils also have free carbonates present in the substratum and are mildly or moderately alkaline. These soils are in productivity class 2. The Chitina, Tonsina, and Tsana soils all have more compact, less porous substrata; lack free carbonates; and are neutral to occasionally mildly alkaline. These soils are in productivity class 1.

On all forest soils, tree growth tends to decline with long-term forest succession. Development of white spruce forests is accompanied by a relatively rapid accumulation of organic matter and mosses on the soil surface. This layer acts as an effective insulator against increased soil temperatures during the summer growing season. Colder soils reduce biological activity and nutrient availability *(Heilman 1968; Van Cleve 1972)*. In thawed counterparts of permafrost soils, colder soil temperatures can eventually lead to a rise in the permafrost level and restricted soil drainage. As white spruce approaches about 50 to 75 years old, tree growth has already begun to slow markedly.

Under natural conditions, a number of factors help interrupt this general trend of decreasing tree productivity. On Klutina and Nizina soils, occasional

flooding results in the organic layer being removed by flood waters or being buried under newly deposited alluvium. Both actions tend to retard decreasing soil temperatures and the associated negative impacts of reduced nutrient availability. In addition, significant amounts of available nutrients are contained in the alluvium *(Zasada 1977)*. Fire, on the other hand, destroys the forest overstory and surface moss-organic layer, resulting in the release of significant quantities of nutrients and an increase in soil temperature. Where permafrost is present, the thickness of the active layer increases and soil drainage is improved *(Viereck and Schandlemeier 1980)*. The relative degree to which the productivity of the site is improved depends on fire intensity.

Forestry-Soils Interpretations

Soil surveys are becoming increasingly more important to forest managers as they seek ways to improve the productivity and management of their lands, and for planning the most efficient use of forest resources. Certain soils have a higher potential productivity, some are more susceptible to windthrow of remaining trees after harvesting, and others will require special efforts to reforest. The detailed descriptions of the soil map units of the survey area list important forestry interpretations.

Each map unit suitable for producing commercial stands of white spruce has information in its description concerning forest vegetation and productivity, limitations for harvesting timber, silvacultural considerations, and suitable logging and management practices. The methods and procedures used by foresters and soil scientists to develop this information are contained in the Natural Resources Conservation Service's *National Forestry Manual (United States Department of Agriculture 1980)* and applicable State supplements.

Table 7 summarizes much of the forestry information given in the map unit descriptions and serves as a quick reference for the more important forestry interpretations. The *ordination symbol* given in Table 7 is derived from a uniform system that groups and labels soils based on potential productivity and principal soil properties in relation to any hazards or limitations of that soil. The first element of the symbol is the *productivity class*, described in the preceding section.

The second element of the symbol, a letter, indicates the major kind of soil limitation for forest management or tree growth. The letter *C* indicates limitations because of the kind or amount of clay in the upper portion of the profile. The letter *F* indicates restrictions because the profile contains large amounts of coarse fragments. The letter *A* indicates little or no limitations or restrictions.

In Table 7, the soils also are rated for a number of factors to be considered in use and management. *Slight*, *moderate*, and *severe* are used to indicate the degree of major soil limitations. For each *moderate* or *severe* rating, a statement in the applicable soil map unit explains the soil factor or factors that are the basis of the rating. Soils with permafrost have a *severe* rating for all interpretations.

Erosion hazard ratings refer to the risk of water erosion and soil loss in well managed forests. A rating of *slight* indicates that expected soil loss is small and no particular preventive measures are needed under ordinary conditions; *moderate* indicates measures are needed to control erosion during road construction and timber harvesting to prevent site degradation; and *severe* indicates that intensive management or special equipment and methods are needed to prevent excessive erosion.

Water erosion results from disturbance of the bare soil surface by raindrop impact and runoff, which detaches soil particles and carries them away. The velocity and volume of surface runoff increases as the gradient and length of slope increases. Soils with high amounts of silt and fine sand, low amounts of organic matter, weak structure, and/or slow permeability are susceptible to increased runoff and accelerated erosion. Although the erosion hazard for survey area forest soils is slight because of the relatively gentle slopes of the area, saturated soil conditions, which occur as seasonal frost thaws in late spring, increase the erosion hazard. Maintaining adequate soil cover, developing water management structures, and avoiding surface disturbances, particularly during saturated conditions, can minimize erosion problems.

Equipment limitations ratings refer to the limits on the operability and use of equipment, year-round or seasonally, as a result of soil characteristics. A rating of *slight* indicates that equipment use is not normally restricted in kind or time of year because of soil factors; *moderate* indicates a short seasonal limitation due to soil wetness, a fluctuating water table, or some other factor; and *severe* indicates a longer seasonal limitation, a need for special equipment, or a hazard in the use of equipment.

The most obvious limitation to the use of equipment is slope. As slope gradient increases, the operability of wheeled equipment becomes restricted and tracked equipment must be used. Very steep slopes may require the use of more sophisticated harvesting systems. The relatively gentle terrain of the survey area results in few equipment limitations because of slope. However, even on level and gently sloping areas, equipment use may be limited by soil wetness, especially in combination with the silty surface texture

of most area soils. Equipment getting stuck in mud and severe soil disturbance contribute to soil erosion.

Seedling mortality ratings refer to the probability of death of naturally occurring and planted tree seedlings as influenced by kinds of soil or topographic conditions. Plant competition is not considered in the ratings. *Slight* indicates no problem is expected under usual conditions; *moderate* indicates some mortality can be expected and extra precautions are advisable; and *severe* indicates that mortality will be high and extra precautions are essential for successful reforestation. In the Copper River Area, soil droughtiness due to low available water capacity and shallow effective rooting depth is a factor contributing to significant seedling mortality problems. *Moderate* and *severe* ratings indicate that special site preparation or reinforcement planting may be needed.

Windthrow hazard ratings consider soil characteristics that affect the development of tree roots and the ability of the soil to hold trees firmly. A rating of *slight* indicates that trees are not normally blown down by wind although strong wind may break trees; *moderate* indicates that an occasional tree may blow down during periods of excessive wetness combined with moderate or strong winds; and *severe* indicates that many trees may blow down during such periods. Restricted rooting depth is the principal reason for increased windthrow hazard. In Interior Alaska, low soil temperatures severely restrict root growth, and roots of all tree species are concentrated in the upper soil horizons *(Tryon and Chapin 1983)*. Soils with *moderate* and *severe* ratings require more caution in thinning operations, more attention to wind direction and speed when designing timber sales and cuts, and contingency plans for periodic salvage of windthrown trees.

Plant competition ratings refer to the likelihood of invasion or growth of understory plants when openings are made in the tree canopy. A rating of *slight* indicates that understory plants are not likely to delay natural reforestation, and planted seedlings have good prospects for development without undue competition; *moderate* indicates that plant competition will delay natural or planted reforestation; and *severe* indicates that competition can prevent natural or planted reforestation.

Favorable climate and soil moisture characteristics, and the naturally occurring vegetation on a soil, account for plant competition problems. In the Copper River Area, the severe climate and relatively slow rate of growth of resprouting shrubs and other understory plants minimize, but do not eliminate, plant competition. A *moderate* rating indicates the need for careful and thorough post-harvest clean-up in preparation for reforestation, and possibly of biological, mechanical, or chemical treatments to retard growth of competing vegetation and allow seedlings to develop.

Forest Management

The silvacultural, or harvest-regeneration, system for white spruce most often used for Interior Alaska forests is clear cutting with site preparation for natural regeneration. Shelterwood and seed tree systems also have been used. Because an adequate seed source and a suitable seedbed of mixed mineral-organic soil are the most important factors in obtaining white spruce regeneration, site preparation, when possible, should be timed to coincide with a satisfactory seed year *(Samson et al. 1983)*. However, good cone and seed years are often more than 10 years apart *(Zasada 1977)*. When white spruce seed is sparse and nontree species colonize the seedbed, possibly restricting the germination and growth of subsequently abundant tree seed *(Fox 1980)*, future site preparation may be needed to control competing vegetation and allow seedlings to establish. Rather than relying on natural regeneration, a more appropriate alternative may be artificial regeneration by seeding or planting immediately after harvest and site preparation.

Stand tending practices can be used to improve the diameter and volume growth of the stand. Thinning, and thinning plus fertilization, can result in a significant increase in the growth rate of remaining trees *(Van Cleve and Zasada 1976)*. Selective and overstory removal cuts to remove broadleaf trees can be used in existing mixed stands to release and improve growth of the remaining white spruce *(Samson et al. 1983)*. The Natural Resources Conservation Service; the Alaska Cooperative Extension; or the Division of Forestry, Alaska Department of Natural Resources can assist land owners and managers in determining specific forestland management needs.

Engineering

This section provides information for planning land uses related to urban development and water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section (page 155).

Information in this section is intended for land use planning, evaluating land use alternatives, and

planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. The hazard of thermokarst subsidence may persist in soils in which the permafrost and perched water table have subsided to below 5 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for on-site investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing this section. Local ordinances and regulations should be considered in planning, site selection, and design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the glossary (page 197).

Building Site Development

Table 8 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe. On-site investigations are required to determine the hazard of thermokarst subsidence due to the presence of buried massive ice features.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, permafrost, or a very firm dense layer; stone content; soil texture; and slope. The time of the year to excavate is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. Soil texture and depth to the water table affect the resistance of the excavation walls or banks to sloughing or caving.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, dwellings with basements, and dwellings without basements. The ratings are based on soil properties, site features, and observed soil performance. A high water table, flooding, shrinking and swelling, frost action, and organic layers can cause the footings to move. A high water table, depth to bedrock or to permafrost, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills generally are limited to less than 6 feet. The ratings are based on soil properties, site features, and

observed performance of the soils. Depth to bedrock or to permafrost, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, potential for frost action, and depth to a high water table affect the traffic-supporting capacity.

Sanitary Facilities

Table 9 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 9 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use, and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use, and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use, and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to permafrost, and flooding affect absorption of the effluent. Large stones, bedrock, permafrost, or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. Unsaturated soil material must be located beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments, and utilize compacted, relatively impervious soil material for the floor and sides to minimize seepage and contamination of local ground water. Aerobic lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet.

Table 9 gives ratings for the natural soil that makes up the lagoon floor. The surface layer, and generally 1 or 2 feet of soil material below the surface layer, are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to permafrost, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability in the soil, or a water table that is high enough to raise the level of sewage in the lagoon, causes a lagoon to function unsatisfactorily, resulting in pollution. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and permafrost can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench and spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil and spread, compacted, and covered daily with a thin layer of soil from a source away from the site. Both types of landfill must be able to carry heavy vehicular traffic, and both involve a risk of ground-water pollution. Ease of excavation and revegetation should be considered.

The ratings in Table 9 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to permafrost, a high water table, slope, and flooding affect both landfill types. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench-type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. On-site investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained off-site,

transported to the landfill, and spread over the waste. Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 10 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is excavated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. Soil performance, after it is stabilized with lime or cement, is not considered in the ratings.

The ratings are based on soil properties, site features, and observed soil performance. The thickness of suitable material is a major consideration. Large stones, a high water table, and slope affect the ease of excavation. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel, or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have one or more of the following characteristics: a plasticity index of more than 10, a high shrink-swell potential, many stones, slopes of more than 25 percent, or a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction, and specifications for each use vary widely. In Table 10, only the probability of finding material in suitable quantity in or below the soil is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel, or a layer of sand or gravel that is as much as 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil are evaluated for use as topsoil. The reclamation potential of the borrow area is also evaluated.

Toxic material and properties such as soil reaction, available water capacity, and fertility affect plant growth. Rock fragments, slope, a water table, soil texture, and thickness of suitable material affect the ease of excavating, loading, and spreading. Slope, a water table, rock fragments, bedrock, and toxic material affect reclamation of the borrow area.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes

of less than 8 percent. They are low in soluble salt content, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils; loamy soils that are relatively high in clay; soils that have only 20 to 40 inches of suitable material; soils that have an appreciable amount of gravel, stones, or soluble salts; or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey; have less than 20 inches of suitable material; have a large amount of gravel, stones, or soluble salts; have slopes of more than 15 percent; or have a seasonal high water table at or near the surface.

The surface layer of most soils generally is preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 11 gives information on the soil properties and site features affecting water management. Restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways are given for each soil. The degree and kind of soil limitations are given for pond reservoir areas. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and if special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, a cemented pan, permafrost or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, permafrost, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. An irrigation system’s design and management are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. Large stones, permafrost, and depth to bedrock or to a cemented pan affect the construction of a system. Depth of the root zone, the amount of salts or sodium, and soil reaction affect the performance of a system.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, permafrost, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, permafrost, and depth to bedrock or a cemented pan affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features listed in Tables 14 and 15 are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, laboratory tests of samples from the survey area, and laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Key soil and water features also are given.

Engineering Index Properties

Table 12 gives estimates of the engineering classification and the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under the heading "Soil Series, Higher Taxa, and Their Morphology" (page 161).

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the glossary (page 197).

Classification of the soils is determined according to the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) *(American Association of State Highway and Transportation Officials 1970)* and the Unified soil classification system *(American Society for Testing and Materials 1974)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups, from A-1 through A-7, based on grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 based on visual inspection.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area

and nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 13 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given in the series descriptions.

Clay as a soil separate, or component, consists of mineral soil particles that are less than 0.002 millimeter in diameter. The estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3-bar moisture tension. Weight is determined after drying the soil at 105 °C. In Table 13—Physical and Chemical Properties of the Soils, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. Laboratory analyses verify values for many soils. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water, and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, more than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion. Factor K is one of six factors

used in the Universal Soil Loss Equation (USLE) to predict the average rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, very fine sand, sand, and organic matter (as much as 4 percent) and on soil structure and permeability. The estimates are modified by the presence of rock fragments. Values of K range from 0.02 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion.

Erosion factor T is an estimate of the maximum average rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion and the amount of soil lost. Soils are grouped according to the amount of stable aggregates 0.84 millimeter in size. Soils containing rock fragments can occur in any group. The groups are as follows:

1. *1 to 9 percent dry soil aggregates.* These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
2. *10 to 24 percent dry soil aggregates.* These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
3. *25 to 39 percent dry soil aggregates.* These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.
4. *25 to 39 percent dry soil aggregates with greater than 35 percent clay or greater than 5 percent calcium carbonate.* These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.
5. *40 to 44 percent dry soil aggregates.* These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.
6. *45 to 49 percent dry soil aggregates.* These soils are very slightly erodible. Crops can easily be grown.
7. *50 percent or more dry soil aggregates.* These soils are very slightly erodible. Crops can easily be grown.
8. *Stony, gravelly, or wet soils and other soils are not subject to wind erosion.*

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In Table 13, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Physical and Chemical Analysis of Selected Soils

The results of physical analysis of several typical pedons in the survey area are given in Table 14 and the results of chemical analysis in Table 15. The data are for soils sampled at carefully selected sites. Unless otherwise indicated, the pedons are representative of the series. However, the horizon designations may differ slightly from the typical soil profile described in the section “Soil Series, Higher Taxa, and Their Morphology” (page 161). The National Soil Survey Laboratory in Lincoln, Nebraska analyzed soil samples.

Most determinations, except those for grain-size analysis and bulk density, were made on soil material smaller than 2 millimeters in diameter. Measurements reported as percent or quantity of unit weight were calculated on an ovendry basis. The methods used in obtaining the data are indicated in the list that follows. The codes in parentheses refer to published methods in the Soil Survey Laboratory Methods Manual *(United States Department of Agriculture 1992)*.

Table 14 procedures:

Sand—(0.05-2.0 mm fraction) weight percentages of material less than 2 mm (3A1).

Silt—(0.002-0.05 mm fraction) pipette extraction, weight percentages of all material less than 2 mm (3A1).

Clay—(fraction less than 0.002 mm) pipette extraction, weight percentages of material less than 2 mm (3A1).

Water retained—pressure extraction, percentage of ovendry weight of less than 2 mm material; 1/3 bar (4B1), 15 bars (4B2).

Water retention difference—between 1/3 and 15 bars for whole soil (4C1).

Bulk Density—of less than 2 mm material, saran-coated clods field moist (4A1a), 1/3 bar (4A1d), ovendry (4A1h).

Table 15 procedures:

Cation-exchange capacity—sum of cations (5A3a).

Cation-exchange capacity—ammonium acetate, pH 7.0, steam distillation (5A8b).

Reaction (pH)—1:1 water dilution (8C1f).

Reaction (pH)—calcium chloride (8C1f).

Organic carbon—wet combustion; Walkley-Black modified acid-dichromate, ferric sulfate titration (6A1c).

Total nitrogen—Kjeldahl (6B3).
Extractable acidity—barium chloride-triethanolamine IV (6H5a).
Extractable cations (bases)—ammonium acetate pH 7.0, atomic absorption; calcium (6N2e), magnesium (6O2d), sodium (6P2b), potassium (6Q2b).

Water Features

Table 16 gives estimates of various water features used in land use planning that involves engineering considerations. These features are described in the following paragraphs.

Hydrologic soil groups are groups of soils that, when saturated, have the same runoff potential under similar storm and ground cover conditions. The soil properties that affect the runoff potential are those that influence the minimum rate of infiltration in a bare soil after prolonged wetting and when the soil is not frozen. These properties include the depth to a seasonal high water table, the intake rate, permeability after prolonged wetting, and the depth to a very slowly permeable layer. The influences of ground cover and slope are treated independently and are not taken into account in hydrologic soil groups.

In the definitions of the hydrologic soil groups, the infiltration rate is the rate at which water enters the soil at the surface and is controlled by surface conditions. The transmission rate is the rate at which water moves through the soil and is controlled by properties of the soil layers.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of very deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well or well drained soils that have a moderately fine to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils that have a moderately fine or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of soils that have a permanent high water table and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in Table 16, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflow from streams or by runoff from adjacent slopes. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered flooding. Standing water in marshes and swamps or in closed depressions is considered to be ponding.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely to occur.

Frequency, duration, and probable dates of occurrence are estimated. Frequency generally is expressed as none, rare, occasional, or frequent. *None* means flooding is not probable; *rare* that it is unlikely but is possible under unusual weather conditions (the chance of flooding is nearly 0 to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs often under normal weather conditions (the chance of flooding is 50 percent in any year). The term *common* includes both frequent and occasional flooding.

Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 to 30 days), and *very long* (more than 30 days). The time of year that flooding is most likely to occur is expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information on flooding is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Local information about the extent and level of flooding and the relation of each soil on the landscape to historic floods also are considered. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates are based mainly on observations of the water table at selected sites and on the evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. Indicated in Table 16 are the depth to the seasonal high water table; the kind of water table—that is, perched, apparent, or artesian; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in Table 16.

An *apparent* water table is indicated by the level at which water stands in a freshly dug, unlined borehole after adequate time for adjustments in the surrounding soil.

A *perched* water table is one that is above an unsaturated zone in the soil. The basis for determining that a water table is perched may be general knowledge of the area. The water table proves to be perched if the water level in a borehole is observed to fall when the borehole is extended.

An *artesian* water table is under hydrostatic head, generally below an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Two numbers in the column showing depth to the water table indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. "More than 6.0" indicates that the water table is below a depth of 6 feet or that it is within a depth of 6 feet for less than a month.

Soil Features

Table 17 gives estimates of several important soil features used in land use planning that involve engineering considerations. These features are described in the following paragraphs.

Depth to bedrock is given if bedrock is within a depth of 60 inches. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Subsidence is the settlement of organic soils or saturated mineral soils of very low density. Subsidence generally results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage or melting of permafrost. Subsidence takes place gradually, usually over a period of several years. Table 17 shows the expected initial subsidence that usually is a result of drainage, and annual subsidence that usually is a result of oxidation or permafrost melt.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

A *low* potential for frost action indicates that the soil is rarely susceptible to the formation of ice lenses; a *moderate* potential indicates that the soil is susceptible to formation of ice lenses, resulting in frost heave and the subsequent loss of soil strength; and a *high* potential indicates that the soil is highly susceptible to formation of ice lenses, resulting in frost heave and the subsequent loss of soil strength.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil.

Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low, moderate,* or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(United States Department of Agriculture 1975)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field, or inferred from those observations, or from laboratory measurements. Table 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Inceptisol.

SUBORDER. Each order is divided into suborders, primarily on the basis of properties that influence soil genesis and are important to plant growth, or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquept (*Aqu*, meaning water, plus *ept*, from Inceptisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Cryaquepts (*Cry*, meaning cold soil, plus *aquept*, the suborder of the Inceptisols that has an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Histic* identifies the subgroup that typifies the great group. An example is Histic Pergelic Cryaquepts.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, thickness of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is loamy, mixed, nonacid, Histic Pergelic Cryaquepts.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series, Higher Taxa, and Their Morphology

This section describes each soil series recognized in the survey area. Characteristics of the soil and the material in which it formed are identified for each soil series. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" *(United States Department of Agriculture 1993)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(United States Department of Agriculture 1975)*. Unless otherwise stated, colors in the descriptions are for moist soil. A pedon, a small three-dimensional area of soil that is typical of the series in the survey area, is described. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units" (page 11).

Chetaslina Series

Taxonomic class: fine-loamy, mixed Typic Cryochrepts
Depth class: very deep (more than 60 inches or 152 cm)
Drainage class: well drained
Permeability: moderate

Position on landscape: broad lacustrine terraces
Parent material: thin silty loess mantle over loamy lacustrine deposits
Slope range: 0 to 7 percent
Elevation: 1400 to 2200 feet (427 to 671 m)
Climatic data (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
Other: Chetaslina series is a thawed counterpart of the permafrost Mendeltna series.

Typical Pedon

Chetaslina silt loam—on a 2 percent slope under white spruce and aspen forest at 1600 feet (487 m) elevation

Oe—4 inches to 0 (10 cm to 0); mucky peat; partially decomposed feather moss and forest litter; clear wavy boundary
A—0 to 2 inches (0 to 5 cm); dark grayish brown (10YR 3/2) moist silt loam; weak very fine subangular blocky structure; very friable, nonsticky and nonplastic; many roots of all sizes; neutral (pH 7.0); clear wavy boundary
Bw—2 to 7 inches (5 to 18 cm); brown (7.5YR 4/4) moist silt loam; weak fine subangular blocky structure; very friable, nonsticky and nonplastic; common fine patches of dark grayish brown (2.5Y 4/2); many very fine, fine, and medium roots: neutral (pH 7.2); abrupt wavy boundary
2C1—7 to 12 inches (18 to 30 cm); dark grayish brown (2.5Y 4/2) moist silty clay loam; strong fine subangular blocky structure; firm, sticky and plastic; common very fine and fine roots; mildly alkaline (pH 7.4); abrupt wavy boundary
3C1—12 to 30 inches (30 to 76 cm); olive gray (5Y 4/2) moist gravelly loam; strong medium platy structure parting to fine subangular blocky; firm, slightly sticky and slightly plastic; strongly effervescent with disseminated lime; 15 percent gravel and 5 percent cobble; moderately alkaline (pH 8.2); diffuse smooth boundary
3C2—30 to 60 inches (76 to 152 cm); dark gray (5Y 4/1) moist gravelly loam; strong medium platy structure parting to strong fine subangular blocky; firm, slightly sticky and slightly plastic; strongly effervescent with disseminated lime; 15 percent gravel and 5 percent cobble; moderately alkaline (pH 8.2)

Typical Pedon Location

Map unit in which located: 455—Chetaslina silt loam, 0 to 7 percent slopes
Location in survey area: about 5 miles (8 km) west of Copper Center; about 1500 feet (457 m) south and 2000 feet (610 m) east of the NW corner of section 3, T.2N., R.1W., Copper River Meridian

Range in Characteristics

Thickness of the organic mat: 2 to 5 inches (5 to 13 cm)
Depth to loamy lacustrine material: 1 to 13 inches (2 to 33 cm)
Reaction: neutral to moderately alkaline

A horizon:
Color—hue of 7.5YR or 10YR; value moist of 2 or 3; chroma moist of 1, 2, or 3; color striations are common
Texture—silt or silt loam
Rock fragments—0 to 5 percent gravel and cobble
Reaction—neutral or mildly alkaline

Bw horizon:
Color—hue of 7.5YR, 10YR, or 2.5Y; value moist of 3 or 4; chroma moist of 1, 2, 3, or 4
Texture—silt loam or silt
Rock fragments—0 to 1 percent; 0 to 1 percent gravel; 0 to 5 percent cobble
Reaction—neutral or moderately alkaline

C horizon:
Color—hue of 10YR, 2.5Y,or 5Y; value moist of 4 or 5; chroma moist of 1 or 2
Texture—loam, clay loam or silty clay loam
Rock fragments—5 to 30 percent; 5 to 30 percent gravel; 0 to 10 percent cobble
Reaction—mildly alkaline or moderately alkaline
Effervescence—slightly to strongly

Chistochina Series

Taxonomic class: sandy, mixed Typic Cryochrepts
Depth class: very deep (more than 60 inches or 152 cm)
Drainage class: somewhat excessively drained
Permeability: in the silty loess mantle—moderate; in the fine sandy loam subsoil—moderately rapid; below this—rapid
Position on landscape: till plains
Parent material: thin loess mantle over sandy glacial till
Slope range: 0 to 7 percent
Elevation: 1400 to 2200 feet (427 to 670 m)
Climatic data (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)

Typical Pedon

Chistochina silt loam—on a 7 percent slope under aspen forest at 2000 feet (609 m) elevation

Oi—3 inches to 0 (8 cm to 0); peat; dark reddish brown (5YR 3/3) fibrous roots, moss, and twigs; abrupt smooth boundary

A—0 to 1 inch (0 to 3 cm); dark brown (10YR 3/3) moist silt loam; moderate medium platy structure; very friable, nonsticky and nonplastic; many roots of all sizes; slightly acid (pH 6.4); clear irregular boundary

2Bw—1 to 8 inches (3 to 20 cm) brown (7.5YR 4/4) moist fine sandy loam; moderate medium subangular blocky structure; very friable, nonsticky and nonplastic; common very fine, fine, and medium roots; slightly acid (pH 6.4); clear wavy boundary

3C1—8 to 17 inches (20 to 43 cm); dark brown (10YR 3/3) moist loamy fine sand with patches of very dark gray (N 3/0); weak medium subangular blocky structure; very friable, nonsticky and nonplastic; few very fine, fine, and medium roots; 10 percent subrounded gravel; neutral (pH 7.0); diffuse smooth boundary

3C2—17 to 31 inches (43 to 78 cm); very dark gray (10YR 3/1) moist fine sand; single grain; loose, nonsticky and nonplastic; 10 percent subrounded gravel and occasional cobble; neutral (pH 7.0); diffuse irregular boundary

3C3—31 to 60 inches (78 to 152 cm); very dark gray (10YR 3/1) moist gravelly fine sand; single grain; loose, nonsticky and nonplastic; 15 percent subrounded gravel and occasional cobble; neutral (pH 7.2)

Typical Pedon Location

Map unit in which located: 402—Chistochina silt loam, 0 to 7 percent slopes

Location in survey area: about 8 miles (12 km) east of Copper Center; about 900 feet (274 m) north and 2600 feet (792 m) east of the SW corner of section 25, T.3N., R.1E., Copper River Meridian

Range in Characteristics

Depth to fine sandy loam material: 1 to 3 inches (3 to 8 cm)

Depth to sandy glacial outwash: 3 to 15 inches (8 to 38 cm)

Thickness of solum: 4 to 11 inches (10 to 28 cm)

A horizon:

Color—hue of 7.5YR or 10YR; value moist of 2 or 3; chroma moist of 1, 2, or 3

Rock fragments—0 to 15 percent; 0 to 10 percent cobble; 0 to 15 percent gravel

Reaction—neutral or slightly acid

2Bw horizon:

Color—hue of 7.5YR or 10YR; value moist of 3 or 4; chroma moist of 3 or 4

Rock fragments—0 to 15 percent; 0 to 10 percent cobble; 0 to 15 percent gravel

Reaction—neutral or slightly acid

3C horizon:

Color—hue of 10YR, 2.5Y, or 5Y; value moist of 2, 3, or 4; chroma moist of 0, 1, 2, or 3

Rock fragments—0 to 30 percent; 0 to 10 percent cobble; 5 to 20 percent gravel

Reaction—neutral or mildly alkaline

Chitina Series

Taxonomic class: coarse-silty, mixed Cumulic Cryoborolls

Depth class: very deep (more than 60 inches or 152 cm)

Drainage class: well drained

Permeability: moderate

Position on landscape: broad lacustrine terraces and stream terraces

Parent material: silty loess

Slope range: 0 to 20 percent

Elevation: 900 to 2200 feet (274 to 426 m)

Climatic data (average annual):

*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)

*air temperature—26 °F (-3 °C)

Other: Chitina series is a thawed counterpart of the permafrost Copper River series.

Typical Pedon

Chitina silt loam—on a 1 percent slope under grasses and forbs at 1100 feet (335 m) elevation

Oi—2 inches to 0 (5 cm to 0); partially decomposed moss, roots, and litter; clear smooth boundary

A—0 to 2 inches (0 to 5 cm); very dark grayish brown (10YR 3/2) and dark brown (10YR 3/3) moist silt loam; colors occur in fine horizontal streaks, with common fine distinct brown (7.5YR 4/4) and strong brown (7.5YR 4/6) mottles; weak very fine subangular blocky structure; very friable, nonsticky

and nonplastic; many fine and medium roots; neutral (pH 7.0); abrupt wavy boundary

A/C—2 to 20 inches (5 to 50 cm); streaked colors dominated by very dark grayish brown (10YR 3/2), dark grayish brown (10YR 4/2), and strong brown (7.5YR 4/2) moist silt loam and very fine sandy loam; colors occur in fine discontinuous horizontal streaks with small lenses of charcoal; weak medium platy structure; very friable, nonsticky and nonplastic; common very fine and fine roots; mildly alkaline (pH 7.4); abrupt wavy boundary

C1—20 to 32 inches (50 to 81 cm); streaked colors of dark brown through black (10YR 2/1, 2/2, and 3/2) moist silt loam and very fine sandy loam; weak coarse platy structure; very friable, nonsticky and nonplastic; 10 percent dark grayish brown (2.5Y 4/2) and dark gray (5Y 4/1) thin convoluted streaks; common very fine and few fine roots; mildly alkaline (pH 7.6); abrupt wavy boundary

C2—32 to 50 inches (81 to 127 cm); very dark grayish brown (10YR 3/2) and dark gray (2.5YR 4/1) moist very fine sandy loam; massive; very friable, nonsticky and nonplastic; common fine prominent brown (7.5YR 4/4) mottles; few very fine roots; mildly alkaline (pH 7.8); abrupt wavy boundary

2C3—50 to 60 inches (127 to 152 cm); dark gray (5Y 4/1) moist silty clay; strong very fine subangular blocky structure; friable, sticky and plastic; strongly effervescent with disseminated lime; moderately alkaline (pH 8.2)

Typical Pedon Location

Map unit in which located: 411—Chitina silt loam, 0 to 2 percent slopes

Location in survey area: 9 miles (14 km) southeast of Kenny Lake; about 2000 feet (610 m) west of the NE corner of section 28, T.2S., R.4E., Copper River Meridian

Range in Characteristics

Depth to clayey substratum: 40 to more than 60 inches (102 to more than 152 cm)

Reaction: neutral or mildly alkaline in the upper horizons, ranging to moderately alkaline in the substratum

A and A/C horizons:

Color—hue of 7.5YR, 10YR, or 2.5Y; value moist of 2, 3, or 4; chroma moist of 1, 2, or 3

Texture—silt, mucky silt loam, silt loam, or very fine sandy loam

Reaction—neutral or mildly alkaline

Other—colors occur in convoluted streaks and patches; thin strata of charcoal often present

C horizon:

Color—hue of 10YR, 2.5Y, or 5Y; value moist of 2, 3, 4, or 5; chroma moist of 0, 1, 2, 3, or 4.

Texture—silt, silt loam, or very fine sandy loam

Reaction—neutral or mildly alkaline

2C horizon, when present:

Color—hue of 2.5Y or 5Y; value moist of 4 or 5; chroma moist of 1 or 2

Texture—silty clay loam, silty clay, or clay

Rock fragments—0 to 15 percent subangular cobbles and pebbles

Effervescence—none to slightly in the upper layers, strongly in the lower layers

Carbonates—disseminated throughout

Copper River Series

Taxonomic class: loamy, mixed Pergelic Cryaquolls

Depth class: very shallow (0 to 10 inches, or 0 to 25 cm) over permafrost

Drainage class: very poorly drained

Permeability: in the organic mat—moderately rapid; in the mineral soil—moderate; in the permafrost—impermeable

Position on landscape: hills, stream terraces, broad lacustrine terraces, and till plains

Parent material: silty loess over various materials including lacustrine clays, glacial till, and alluvial sand and gravel

Slope range: 0 to 20 percent

Elevation: 900 to 2200 feet (274 to 670 m)

Climatic data (average annual):

*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)

*air temperature—26 °F (-3 °C)

Other: Thawed counterparts of the Copper River series are the Chitina, Kenny Lake, and Tonsina series.

Typical Pedon

Copper River peat—on a 4 percent slope under black spruce forest at 1200 feet (365 m) elevation

Oi—9 to 5 inches (22 to 12 cm); dark brown (7.5YR 3/4) moist peat; slightly decomposed moss, twigs, and root fibers; clear smooth boundary

Oe—5 inches to 0 (12 cm to 0); black (10YR 2/1) moist mucky peat; partially decomposed moss, twigs, and root fibers; thin lenses of silty material increasing with depth; clear smooth boundary

A—0 to 3 inches (0 to 8 cm); black (10YR 2/1), very dark brown (10YR 2/2), and dark brown (10YR 3/2) moist silt loam in thin strata; moderate medium

subangular blocky structure; very friable, nonsticky and nonplastic; neutral (pH 6.8); abrupt smooth boundary

Af—3 to 13 inches (8 to 33 cm); black (10YR 2/1), very dark brown (10YR 2/2), and dark brown (10YR 3/2) moist silt loam; frozen on August 10, 1983

Typical Pedon Location

Map unit in which located: 404—Copper River peat, 2 to 7 percent slopes

Location in survey area: about 10 miles (16 km) east of Chitina on the McCarthy Road; about 2300 feet (700 m) north and 2000 feet (610 m) west of the SE corner of section 17, T.4S., R.7E., Copper River Meridian

Range in Characteristics

Thickness of the organic mat: 8 to 14 inches (20 to 38 cm)

Depth to permafrost: 0 to 10 inches (0 to 25 cm) below the mineral surface

Reaction: strongly acid to slightly acid

Oa/A horizon (when present):

Color—hue of 7.5YR or 10YR; value moist of 2, 3, or 4; chroma moist of 1, 2, or 3

Reaction—strongly acid to neutral

A horizon:

Color—hue of 7.5YR or 10YR; value moist of 2, 3, or 4; chroma moist of 1, 2, or 3

Texture—silt loam, mucky silt loam, silt, or very fine sandy loam

Reaction—slightly acid to moderately alkaline

Af horizon:

Color—hue of 7.5YR, 10YR, or 2.5YR; value moist of 2, 3, or 4; chroma moist of 1, 2, or 3

Texture—silt loam, silt, or very fine sandy loam

Other—lenticular ice and massive ice wedges are common in many locations—strata of decomposed organic matter often present

Reaction—neutral to moderately alkaline

Cryochrepts

Taxonomic class: Cryochrepts

Depth class: very shallow to very deep (10 to greater than 60 inches, or 25 to greater than 152 cm) over bedrock or permafrost

Drainage class: well drained to somewhat excessively drained

Permeability: above the bedrock or permafrost—moderately slow to moderately rapid; below this—impermeable

Position on landscape: mountainsides and escarpments

Parent material: loamy and clayey lacustrine materials, sandy and gravelly alluvium, loamy glacial till, cobbly and flaggy colluvium, or silty eolian deposits

Slope range: 30 to 70 percent

Elevation: 600 to 2000 feet (183 to 610 m)

Climatic data (average annual):

*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)

*air temperature—26 °F (-3 °C)

Sample Pedon

Oe—8 inches to 0 (20 cm to 0); dark reddish brown (2.5YR 2.5/2) moist mucky peat; undecomposed moss, twigs, and root fibers; slightly acid (pH 6.2); clear smooth boundary

A—0 to 1 inch (0 to 3 cm); dark brown (10YR 3/3) moist silt loam with streaks and patches of dark yellowish brown (10YR 4/4) and very dark brown (10YR 2/2); moderate medium granular structure; very friable, nonsticky and nonplastic; many roots of all sizes; neutral (pH 7.2); irregular smooth boundary

Bw—1 to 3 inches (3 to 8 cm); dark yellowish brown (10YR 3/4) moist silt loam with patches and streaks of dark brown (10YR 3/3); moderate thin platy structure; very friable, nonsticky and nonplastic; many roots of all sizes; neutral (pH 7.0); clear smooth boundary

2C1—3 to 14 inches (8 to 35 cm); dark grayish brown (2.5Y 4/2) moist silty clay loam; strong coarse granular structure; firm, sticky and plastic; few very fine, fine, and medium roots; mildly alkaline (pH 7.6); gradual wavy boundary

2C2—14 to 27 inches (35 to 68 cm); olive gray (5Y 5/2) moist silty clay; strong coarse granular structure; firm, very sticky and very plastic; moderately alkaline (pH 8.0); slightly effervescent; 10 percent subrounded gravel; abrupt wavy boundary

2C2f—27 to 37 inches (68 to 93 cm); olive gray (5Y 5/2) moist silty clay; moderately alkaline (pH 8.2); strongly effervescent; 10 percent subrounded gravel; frozen July 21, 1982

Sample Pedon Location

Map unit in which located: 424—Cryorthents and Cryochrepts, 30 to 70 percent slopes

Location in survey area: about 900 feet (275 m) south and 300 feet (90 m) west of the northeast corner of section 19, T.6N., R.1W., Copper River Meridian

Range in Characteristics

Depth to bedrock: 10 to over 60 inches (25 to over 152 cm)
Depth to permafrost: 10 to over 60 inches (25 to over 152 cm) below the mineral surface
Reaction: neutral to moderately alkaline
Texture: silt loam, loam, sandy loam, clay loam, silty clay loam, or clay
Rock fragments: 0 to 60 percent
Reaction: neutral to moderately alkaline

Cryofibrists

Taxonomic class: Cryofibrists
Depth class: very deep (more than 60 inches or 152 cm)
Drainage class: very poorly drained
Permeability: moderately rapid
Position on landscape: muskegs
Microtopography: depressions and along the perimeter of lakes and ponds
Parent material: organic materials
Slope range: 0 to 1 percent
Elevation: 900 to 2100 feet (274 to 610 m)
Climatic data (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)

Sample Pedon

Oi1—0 to 11 inches (0 to 27 cm); dark reddish brown (5YR 3/2, squeezed) peat; slightly decomposed sedge, twig, and root fibers; about 95 percent fibers unrubbed, 85 percent fibers rubbed; many very fine, fine, and medium roots; slightly acid (pH 6.4); gradual smooth boundary
Oi2—11 to 60 inches (27 to 152 cm); very dark brown (10YR 2/2, squeezed) peat; undecomposed sedge, twig, and root fibers; about 90 percent fibers unrubbed, 80 percent fibers rubbed; few very fine, fine, and medium roots; slightly acid (pH 6.4)

Sample Pedon Location

Map unit in which located: 422—Cryofibrists-Cryohemists complex, 0 to 2 percent slopes
Location in survey area: about 5 miles (8 km) southwest of Glennallen; about 600 feet (183 m) south and 1600 feet (488 m) west of the northwest corner of section 8, T.3N., R.2W., Copper River Meridian

Range in Characteristics

Depth to water layers: 10 to over 60 inches (25 to over 152 cm)
Depth to mineral soil: 16 to over 60 inches (40 to over 152 cm)
Reaction: moderately acid to neutral

Cryohemists

Taxonomic class: Cryohemists
Depth class: very shallow to very deep (10 to greater than 60 inches, or 25 to greater than 152 cm) over permafrost
Drainage class: very poorly drained
Permeability: above the mineral soil or permafrost—moderately rapid; below this—impermeable if permafrost, or very slow to moderately rapid if mineral soil
Position on landscape: muskegs
Microtopography: depressions
Parent material: organic materials overlying coarse textured alluvium, loamy glacial till, or lacustrine deposits
Slope range: 0 to 2 percent
Elevation: 900 to 2100 feet (274 to 640 m)
Climatic data (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)

Sample Pedon

Oi—0 to 3 inches (0 to 7 cm); very dusky red (2.5YR 2.5/2, squeezed) peat; slightly decomposed root, sedge, and ericaceous shrub fibers; about 90 percent fibers unrubbed, 60 percent fibers rubbed; many very fine, fine, and medium roots; slightly acid (pH 6.2); clear wavy boundary
Oe1—3 to 9 inches (7 to 22 cm); dark reddish brown (5YR 3/2, squeezed) mucky peat; partially decomposed root, sedge, and ericaceous shrub fibers; about 60 percent fibers unrubbed, 40 percent fibers rubbed; many very fine, fine, and medium roots; slightly acid (pH 6.4); gradual wavy boundary
Oe2—9 to 19 inches (22 to 48 cm); dark reddish brown (7.5YR 3/3, squeezed) mucky peat; partially decomposed roots and sedge fibers; about 60 percent fibers unrubbed, 35 percent fibers rubbed; common very fine, fine, and medium roots; slightly acid (pH 6.4); abrupt wavy boundary
Oe2f—19 to 22 inches (48 to 55 cm); dark reddish brown (7.5YR 3/3, squeezed) mucky peat; partially decomposed roots and sedge fibers; about 60

percent fibers unrubbed, 35 percent fibers rubbed; slightly acid (pH 6.4); clear irregular boundary

Cf—22 to 29 inches (55 to 73 cm); dark grayish brown (2.5Y 4/2) moist clay loam; 10 percent subrounded gravel; mildly alkaline (pH 7.4); frozen July 29, 1984

Sample Pedon Location

Map unit in which located: 423—Cryohemists, 0 to 2 percent slopes

Location in survey area: about 12 miles (19 km) west of Copper Center; about 300 feet (91 m) south and 1400 feet (427 m) west of the NW corner of section 21, T.2N., R.3W., Copper River Meridian

Range in Characteristics

Thickness of the organic mat: 16 to over 60 inches (40 to over 152 cm)

Depth to permafrost: 16 to over 60 inches (40 to over 152 cm)

Depth to mineral soil: 16 to over 60 inches (40 to over 152 cm)

Reaction: moderately acid to neutral

Texture: silt loam, loam, sandy loam, clay loam, silty clay loam, or clay

Rock fragments: 0 to 60 percent

Cryorthents

Taxonomic class: Cryorthents

Depth class: very deep (more than 60 inches or 152 cm)

Drainage class: well drained to excessively drained

Permeability: moderately slow to rapid

Position on landscape: escarpments

Parent material: gravelly alluvium, loamy and clayey lacustrine material, or loamy glacial till

Slope range: 30 to 70 percent

Elevation: 800 to 1800 feet (244 to 549 m)

Climatic data (average annual):

*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)

*air temperature—26 °F (-3 °C)

Sample Pedon

A—0 to 7 inches (0 to 18 cm); dark gray (10YR 4/1) moist loam; moderate fine granular structure; friable; slightly sticky and slightly plastic; common very fine and fine roots; 5 percent subrounded gravel; occasional subrounded cobble; mildly alkaline (pH 7.4); gradual smooth boundary

C1—7 to 34 inches (18 to 86 cm); dark gray (10YR 4/1) moist clay loam; moderate fine subangular blocky structure; firm, sticky and plastic; common very fine and fine roots; mildly alkaline (pH 7.8); gradual smooth boundary

C2—34 to 60 inches (86 to 152 cm); dark gray (5Y 4/1) moist silty clay loam; moderate fine subangular blocky structure; firm; slightly sticky and slightly plastic; occasional subrounded gravel; mildly alkaline (pH 7.8)

Sample Pedon Location

Map unit in which located: 424—Cryorthents and Cryochrepts, 30 to 70 percent slopes

Location in survey area: about 12 miles (19 km) southeast of Kenny Lake; about 1300 feet (396 m) north and 1200 feet (366 m) west of the southeast corner of section 32, T.2S., R.5E., Copper River Meridian

Range in Characteristics

Texture: sand, sandy loam, loam, silt loam, clay loam, silty clay loam, or clay

Rock fragments: 0 to 60 percent

Reaction: neutral to moderately alkaline

Dadina Series

Taxonomic class: sandy-skeletal, mixed Histic Pergelic Cryaquepts

Depth class: shallow to moderately deep (18 to 35 inches, or 46 to 89 cm) over permafrost

Drainage class: very poorly or poorly drained

Permeability: in the organic mat—moderately rapid; in the silty loess mantle—moderate; in the gravelly substratum—very rapid; in the permafrost—impermeable

Position on landscape: broad lacustrine terraces and till plains

Microtopography: localized outwash deposits

Parent material: thin silty loess mantle over gravelly glacial outwash

Slope range: 0 to 2 percent

Elevation: 1400 to 2300 feet (427 to 701 m)

Climatic data (average annual):

*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)

*air temperature—26 °F (-3 °C)

Typical Pedon

Dadina peat—on a 1 percent slope under black spruce forest at 1600 feet (487 m) elevation

Oi—10 to 4 inches (25 to 10 cm); dark brown (7.5YR 3/4) peat; slightly decomposed moss and root fibers; clear smooth boundary
Oe—4 inches to 0 (10 cm to 0); dark brown (7.5YR 3/2) mucky peat; partially decomposed root, moss, and twig fibers; abrupt smooth boundary
A—0 to 3 inches (0 to 8 cm); very dark brown (10YR 2/2) moist mucky silt loam; moderate medium subangular blocky structure; friable, slightly sticky and slightly plastic; many roots of all sizes; slightly acid (pH 6.2); occasional rounded pebbles and cobble; clear wavy boundary
2C1—3 to 7 inches (8 to 18 cm); dark yellowish brown (10YR 4/4) and dark brown (10YR 4/3) moist very gravelly sand; single grain; loose, nonsticky and nonplastic; few very fine and fine roots; slightly acid (pH 6.2); 45 percent rounded pebbles and 10 percent rounded cobble; clear wavy boundary
2C2—7 to 22 inches (18 to 55 cm); dark grayish brown (10YR 4/2) moist very gravelly sand; single grain; loose, nonsticky and nonplastic; slightly acid (pH 6.4); 50 percent rounded pebbles and 5 percent rounded cobble; abrupt wavy boundary
2C2f—22 to 32 inches (55 to 81 cm); dark grayish brown (10YR 4/2) moist very gravelly sand; 50 percent rounded pebbles and 5 percent rounded cobble; frozen on September 9, 1982

Typical Pedon Location

Map unit in which located: 425—Dadina peat, 0 to 2 percent slopes
Location in survey area: about 9 miles (14 km) southeast of Copper Center; about 2200 feet (671 m) north and 1600 feet (488 m) east of the SE corner of section 28, T.2N., R.2W., Copper River Meridian

Range in Characteristics

Depth to contrasting gravelly material: 1 to 5 inches (3 to 13 cm)
Depth to permafrost: 18 to 35 inches (46 to 89 cm) below the mineral surface
Thickness of solum: 1 to 5 inches (3 to 13 cm)

O horizon:
Thickness—8 to 12 inches (20 to 30 cm)
Reaction—strongly acid to slightly acid

A horizon:
Color—hue of 10YR, 2.5YR, or 5Y; value moist of 2, 3, or 4; chroma moist of 2 or 3
Texture—mucky silt loam, silt loam, or silt
Rock fragments—0 to 10 percent gravel and cobble
Reaction—slightly acid or neutral

2C horizon:
Color—hue of 10YR, 2.5YR, or 5Y; value moist of 4 or 5; chroma moist of 2, 3, or 4
Texture—sand or loamy sand
Rock fragments—45 to 70 percent; 40 to 65 percent gravel; 5 to 25 percent cobble
Reaction—slightly acid or neutral

2Cf horizon:
Color—hue of 10YR, 2.5YR, or 5Y; value moist of 4 or 5; chroma moist of 2 or 3
Texture—sand or loamy sand
Rock fragments—45 to 70 percent; 40 to 65 percent gravel; 5 to 25 percent cobble
Reaction—slightly acid or neutral

Gakona Series

Taxonomic class: very fine, mixed (calcareous) Typic Cryorthents
Depth class: very deep (more than 60 inches or 152 cm)
Drainage class: well drained
Permeability: moderate
Position on landscape: broad lacustrine terraces
Parent material: thin silty loess mantle over clayey lacustrine deposits
Slope range: 0 to 20 percent
Elevation: 1100 to 2000 feet (335 to 610 m)
Climatic data (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
Other: Gakona series is a thawed counterpart of the permafrost Klawasi series.

Typical Pedon

Gakona silt loam—on a 1 percent slope under white spruce forest at 1200 feet (365 m) elevation

Oi—1 inch to 0 (3 cm to 0); peat; undecomposed mat of moss, roots, leaves, and other litter; abrupt smooth boundary
A—0 to 1 inch (0 to 3 cm); very dark grayish brown (10YR 3/2) moist silt loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; very friable, nonsticky and nonplastic; many roots of all sizes; neutral (pH 6.6); clear smooth boundary
AC—1 to 5 inches (3 to 13 cm); dark grayish brown (2.5Y 4/2) moist silt loam, light brownish gray (2.5Y 6/2) dry; weak thin platy structure; very friable, nonsticky and nonplastic; common fine and medium distinct mottles of brown (7.5YR 5/8) dry;

common very fine and fine roots; mildly alkaline (pH 7.4); abrupt smooth boundary

2C1—5 to 17 inches (13 to 43 cm); dark grayish brown (2.5Y 4/2) and olive gray (5Y 4/2) moist silty clay; strong fine subangular blocky structure; friable, sticky and plastic; few very fine and fine roots; mildly alkaline (pH 7.6); clear smooth boundary

2C2—17 to 31 inches (43 to 79 cm); olive gray (5Y 4/2) moist silty clay; weak very coarse prismatic structure parting to strong fine subangular blocky; firm, sticky and plastic; few fine roots in thin cracks between prisms; effervescent with disseminated lime; moderately alkaline (pH 8.0); gradual smooth boundary

2C3—31 to 46 inches (79 to 116 cm); dark gray (5Y 4/1) moist silty clay; strong fine subangular blocky structure; firm, sticky and plastic; few fine roots; effervescent with disseminated lime; moderately alkaline (pH 8.0); clear smooth boundary

2C4—46 to 52 inches (116 to 132 cm); dark gray (5Y 4/1) moist silty clay; strong fine subangular blocky structure; firm, sticky and plastic; gray (5Y 5/1) silty clay loam in wavy discontinuous bands about 1 inch (2 cm) thick; few fine roots; effervescent with disseminated lime; moderately alkaline (pH 8.0); few subangular cobbles and pebbles at the base of horizon; clear smooth boundary

2C5—52 to 60 inches (132 to 152 cm); dark gray (5Y 4/1) moist silty clay; strong fine and medium angular blocky structure; very firm, sticky and plastic; few irregular pockets of loamy sand about 2 inches (5 cm) in diameter; few fine roots in cracks between peds; some blocks with broken strata of darker and lighter color values, each less than 1 inch (2 cm) thick, parallel but not necessarily horizontal; effervescent with disseminated lime; moderately alkaline (pH 8.0)

Typical Pedon Location

Map unit in which located: 441—Gakona silt loam, 0 to 2 percent slopes

Location in survey area: about 1 mile (2 km) west of Kenny Lake; about 1300 feet (396 m) north and 300 feet (91 m) east of the SW corner of section 36, T.1S., R.3E., Copper River Meridian

Range in Characteristics

Depth to clayey substratum: 1 to 8 inches (2 to 20 cm)
Thickness of organic mat: 1 to 5 inches (2 to 13 cm)
Reaction: slightly acid to moderately alkaline

A horizon:
Color—hue of 7.5YR or 10YR; value moist of 2 or 3; chroma moist of 1, 2, or 3; colors often in horizontal and convoluted streaks and patches
Texture—silt loam, mucky silt loam, or silt
Reaction—slightly acid or neutral

AC horizon (when present):
Color—hue of 7.5YR, 10YR, or 2.5Y; value moist of 3 or 4; chroma moist of 2, 3, or 4; colors often in horizontal and convoluted streaks and patches.
Texture—silt loam, mucky silt loam, or silt

2C horizon:
Color—hue of 2.5Y or 5Y; value moist of 4 or 5; chroma moist of 1 or 2
Texture—silty clay or clay
Rock fragments—0 to 25 percent; 0 to 20 percent gravel; 0 to 10 percent cobble
Reaction—mildly alkaline to moderately alkaline
Effervescence—slightly to strongly

Gulkana Series

Taxonomic class: coarse-silty over sandy or sandy-skeletal, mixed Typic Cryochrepts
Depth class: very deep (more than 60 inches or 152 cm)
Drainage class: well drained
Permeability: in the silty loess mantle—moderate; in the sand and gravel—rapid
Position on landscape: stream terraces
Parent material: silty loess over sandy and gravelly alluvium
Slope range: 0 to 20 percent
Elevation: 900 to 1400 feet (274 to 432 m)
Climatic data (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)

Typical Pedon

Gulkana silt loam—on a 1 percent slope under quaking aspen at 1100 feet (335 m) elevation

Oi—3 inches to 0 (8 cm to 0); peat; undecomposed mat of roots, mosses, leaves, and other forest litter; abrupt smooth boundary

A—0 to 1 inch (0 to 3 cm); very dark grayish brown (10YR 3/2) moist silt loam, brown (10YR 4/3) dry; moderate fine granular structure; soft, very friable, nonsticky and nonplastic; many very fine and fine, common medium, and few coarse roots; 5 percent well rounded gravel; neutral (pH 6.6); abrupt wavy boundary

Bw1—1 to 4 inches; (3 to 10 cm); dark yellowish brown (10YR 3/4) moist silt loam, yellowish brown (10YR 5/4) dry; weak fine subangular blocky

structure; soft, very friable, nonsticky and nonplastic; common very fine and fine, and few medium and coarse roots; 5 percent well rounded gravel; neutral (pH 6.8); clear wavy boundary

Bw2—4 to 14 inches (10 to 36 cm); dark grayish brown (10YR 4/2) moist silt loam, grayish brown (10YR 5/2) dry; weak thin platy structure; soft, very friable, nonsticky and nonplastic; many medium and large faint mottles of dark yellowish brown (10YR 3/4) and yellowish brown (10YR 5/4) dry; few very fine and medium roots; 5 percent well rounded gravel; neutral (pH 7.0); clear wavy boundary

2C1—14 to 36 inches (36 to 91 cm); variegated very gravelly sand; single grain; loose, nonsticky and nonplastic; few very fine roots; 40 percent gravel and 10 percent cobble; mildly alkaline (pH 7.8); abrupt wavy boundary

2C2—36 to 43 inches (91 to 109 cm); dark grayish brown (2.5Y 4/2) moist fine sand; single grain; loose, nonsticky and nonplastic; few very fine roots; mildly alkaline (pH 7.8); abrupt wavy boundary

2C3—43 to 52 inches (109 to 132 cm); variegated very gravelly fine sand, variable colors dominated by very dark gray (10YR 3/1); single grain; loose, nonsticky and nonplastic; 40 percent well rounded gravel and 10 percent well rounded cobble; carbonate coatings on undersides of coarse fragments; mildly alkaline (pH 7.8); clear smooth boundary

2C4—52 to 60 inches (132 to 152 cm); variegated very cobbly sand, variable colors dominated by very dark gray (10YR 3/1); single grain; loose, nonsticky and nonplastic; 25 percent well rounded gravel and 20 percent well rounded cobble; carbonate coatings on the undersides of coarse fragments; mildly alkaline (pH 7.8)

Typical Pedon Location

Map unit in which located: 429—Gulkana silt loam, 0 to 2 percent slopes

Location in survey area: about 1/2 mile (1 km) west of Copper Center; about 800 feet (244 m) west and 600 feet (183 m) south of the NE corner of section 13, T.1N., R.1E., Copper River Meridian

Range in Characteristics

Depth to sand and gravel: 12 to 30 inches (30 to 76 cm)
Thickness of solum: 6 to 16 inches (15 to 41 cm)

A horizon:
Color—hue of 7.5YR or 10YR; value moist of 2, 3, or 4; chroma moist of 1, 2, or 3; colors often in horizontal and convoluted streaks and patches
Texture—silt, silt loam, or very fine sandy loam
Reaction—neutral or mildly alkaline

Bw horizon:
Color—hue of 7.5YR or 10YR; value moist of 3 or 4; chroma moist of 2, 3, or 4; colors often in horizontal and convoluted streaks and patches
Texture—silt loam, silt or very fine sandy loam
Rock fragments—0 to 5 percent well rounded cobbles and pebbles
Reaction—neutral to mildly alkaline

2C horizon:
Color—hue of 10YR, 2.5Y, or 5Y; value moist of 1, 2, 3, or 4; chroma moist of 1, 2, 3, or 4
Texture—sand or fine sand
Rock fragments—35 to 75 percent; 35 to 75 percent gravel; 0 to 30 percent cobble with lime coatings on undersides
Reaction—neutral to moderately alkaline

Hanagita Series

Taxonomic class: loamy, mixed Lithic Cryoborolls
Depth class: shallow (12 to 20 inches, or 30 to 50 cm) over consolidated andesite and limestone
Drainage class: well drained
Permeability: moderate
Position on landscape: hills
Microtopography: ridge tops and shoulder slopes
Parent material: silty loess over a thin layer of glacial till underlain by bedrock
Slope range: 10 to 55 percent
Elevation: 800 to 2200 feet (244 to 670 m)
Climatic data (average annual):
*precipitation—14 inches (36 cm); range—8 to 17 inches (20 to 53 cm)
*air temperature—26 °F (-3 °C)

Typical Pedon

Hanagita silt loam—on a 25 percent slope under white spruce at 1300 feet (396 m) elevation

Oi—3 inches to 0 (8 cm to 0); dark brown (7.5YR 3/3) peat; slightly decomposed moss, twigs, and root fibers; grayish brown (10YR 5/2) loess streaks throughout; abrupt smooth boundary

A—0 to 3 inches (0 to 8 cm); dark brown (10YR 3/3) moist silt loam, dark grayish brown (10YR 5/3) dry; weak very fine granular and very thin platy structure; very friable, nonsticky and nonplastic;

occasional striations of light yellowish brown (10YR 6/4) and olive gray (5YR 5/2) dry; many very fine, fine, and medium roots; neutral (pH 6.8); clear smooth boundary

A/B—3 to 7 inches (8 to 18 cm); dark brown (10YR 3/3) moist silt loam, grayish brown (10YR 5/2) dry; weak thin platy structure; very friable, nonsticky and nonplastic; bands and pockets of dark yellowish brown (10YR 4/4) dry; common very fine, fine, and medium roots; neutral (pH 6.8); clear wavy boundary

Bw—7 to 15 inches (18 to 38 cm); dark yellowish brown (10YR 4/4) moist silt loam, brown (10YR 5/3) dry; weak thin platy structure; very friable, nonsticky and nonplastic; few fine and medium roots; neutral (pH 7.0); gradual wavy boundary

2C—15 to 18 inches (38 to 46 cm); brown (10YR 4/3) moist gravelly silt loam, grayish brown (10YR 5/2) dry; weak medium subangular blocky structure; very friable, nonsticky and nonplastic; few fine and medium roots; neutral (pH 7.2); abrupt wavy boundary

R—18 inches (46 cm); consolidated andesite bedrock with occasional fractures

Typical Pedon Location

Map unit in which located: 464—Strelna-Hanagita-Copper River complex, 15 to 55 percent slopes

Location in survey area: about 10 miles (16 km) east of Chitina; about 1700 feet (518 m) south and 500 feet (152 m) east of the NW corner of section 22, T.4S., R.7E., Copper River Meridian

Range in Characteristics

Thickness of the organic mat: 2 to 5 inches (5 to 13 cm)

Depth to glacial till: 10 to 17 inches (25 to 43 cm)

Depth to bedrock: 12 to 20 inches (30 to 50 cm)

Thickness of solum: 8 to 17 inches (20 to 43 cm)

A horizon:

Color—hue of 7.5YR or 10YR; value moist of 3 or 4; chroma moist of 2 or 3; thin lenses and pockets of 10YR 2/1, 10YR 6/4, and 5Y 4/2 dry

Texture—silt, silt loam, or very fine sandy loam

Bw horizon:

Color—hue of 7.5YR or 10YR; value moist of 3, 4, or 5; chroma moist of 2, 3, or 4; thin pockets of material with moist value of 5 or 6 are common

Texture—silt, silt loam, or very fine sandy loam

2C horizon:

Color—hue of 7.5YR, 10YR, or 2.5Y; value moist of 3, 4, or 5; chroma moist of 2, 3, or 4

Texture—sandy loam or silt loam

Rock fragments—10 to 35 percent

Effervescence—none to slightly

Kenny Lake Series

Taxonomic class: coarse-silty over clayey, mixed Cumulic Cryoborolls

Depth class: very deep (more than 60 inches or 152 cm)

Drainage class: well drained

Permeability: moderate

Position on landscape: broad lacustrine terraces

Parent material: silty loess mantle overlying lacustrine clays

Slope range: 0 to 20 percent

Elevation: 900 to 1400 feet (274 to 432 m)

Climatic data (average annual):

*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)

*air temperature—26 °F (-3 °C)

Other: Kenny Lake series is a thawed counterpart of the permafrost Copper River series.

Typical Pedon

Kenny Lake silt loam—on a 1 percent slope under white spruce forest at 1300 feet (396 m) elevation

Oi—3 inches to 0 (8 cm to 0); peat; undecomposed moss, roots, and forest litter; some silty dust; clear wavy boundary

A—0 to 5 inches (0 to 12 cm); grayish brown (10YR 5/2) silt loam; very dark brown (10YR 2/2) moist; moderate fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; very dark grayish brown (10YR 3/2) and very dark gray (10YR 3/1) moist streaks; many very fine and medium roots; hydrophobic due to abundant fungal hyphae; mildly alkaline (pH 7.6)

A/B—5 to 17 inches (12 to 43 cm); grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist and rubbed; moderate thin platy structure; soft, very friable, slightly sticky and slightly plastic; very dark gray (10YR 3/1), dark brown (10YR 3/3), dark yellowish brown (10YR 3/4), dark gray (10YR 4/1), dark grayish brown (10YR 4/2), and brown (7.5YR 4/4) moist streaks and patches all less than 1 inch thick with no

orientation; many very fine and few medium roots; mildly alkaline (pH 7.8); abrupt irregular boundary

C1—17 to 24 inches (43 to 60 cm); olive gray (5Y 5/2) very fine sandy loam, olive gray (5Y 4/2) moist; strong thin platy structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; mildly alkaline (pH 7.6); abrupt wavy boundary

2C2—24 to 30 inches (60 to 76 cm); olive gray (5Y 5/2) moist silty clay loam; strong very fine subangular blocky structure; friable, sticky and plastic; no roots; 10 to 15 percent gravel and cobble; strongly effervescent with disseminated lime; moderately alkaline (pH 8.2)

2C3—30 to 60 inches (76 to 152 cm); olive gray (5Y 4/2) moist silty clay; strong very fine subangular blocky structure; friable, sticky and plastic; no roots; 10 percent gravel and cobble; strongly effervescent with disseminated lime; moderately alkaline (pH 8.2)

Typical Pedon Location

Map unit in which located: 407—Kenny Lake silt loam, 0 to 2 percent slopes

Location in survey area: 7 miles (11 km) southeast of Kenny Lake; about 1100 feet (335 m) east and 500 feet (152 m) south of the NW corner of section 19, T.2S., R.4E., Copper River Meridian

Range in Characteristics

Depth to clayey substratum: 16 to 27 inches (40 to 69 cm)

Reaction: neutral or mildly alkaline in the upper horizons, ranging to moderately alkaline in the clayey substratum

A horizon:

Color—hue of 7.5YR or 10YR; value moist of 2 or 3; chroma moist of 1 or 2

Texture—silt, silt loam, or very fine sandy loam

Reaction—neutral or mildly alkaline

Other—streaks and stratas of varying thickness

A/B horizon:

Color—hue of 7.5YR, 10YR, or 2.5Y; value moist of 2 or 3; chroma moist of 1 or 2

Texture—silt, silt loam, or very fine sandy loam

Reaction—neutral or mildly alkaline

Other—many streaks and patches of varying thickness

2C horizon:

Color—hue of 2.5Y or 5Y; value moist of 4 or 5; chroma moist of 1 or 2

Texture—silty clay loam, silty clay, or clay

Effervescence—none to slightly in the upper part, strongly with depth

Free carbonates—disseminated throughout

Klanelneechena Series

Taxonomic class: sandy, mixed Pergelic Cryaquolls

Depth class: 15 to 34 inches (38 to 86 cm) over permafrost

Drainage class: very poorly drained or poorly drained

Permeability: in the organic mat— moderately rapid; in the silty loess mantle—moderate; in the sandy material—rapid; in the permafrost—impermeable

Position on landscape: broad lacustrine terraces and till plains

Microtopography: depressions between drumlins and moraines and localized glacial outwash deposits

Parent material: thin silty loess mantle underlain by sandy alluvium or friable glacial outwash deposits

Slope range: 0 to 7 percent

Elevation: 1400 to 2300 feet (427 to 701 m)

Climatic data (average annual):

*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)

*air temperature—26 °F (-3 °C)

Other: A thawed counterpart of the Klanelneechena series in this survey area is the Stuck series.

Typical Pedon

Klanelneechena peat—on a 1 percent slope under black spruce forest at 1500 feet (457 m) elevation

Oi—12 to 9 inches (30 to 23 cm); black (10YR 2/1) moist peat; slightly decomposed moss, twigs, and roots; abrupt wavy boundary

Oe—9 to 4 inches (23 to 10 cm); black (10YR 2/1) moist mucky peat; partially decomposed roots, twigs, and moss fibers; abrupt wavy boundary

Oe2—4 inches to 0 (10 cm to 0); dark reddish brown (2.5YR 2.5/2) moist mucky peat; partially decomposed roots, twigs, and moss fibers; abrupt irregular boundary

A—0 to 1 inch (0 to 3 cm); very dark brown (10YR 2/2) moist mucky silt loam; weak fine granular structure; very friable, nonsticky and nonplastic; many roots of all sizes; slightly acid (pH 6.4); diffuse wavy boundary

2C—1 to 15 inches (3 to 38 cm); very dark gray (10YR 3/1) moist coarse sand; single grain; loose, nonsticky and nonplastic; few very fine roots; slightly acid (pH 6.4); diffuse irregular boundary

2Cf—15 to 25 inches (38 to 64 cm); very dark gray (10YR 3/1) moist coarse sand; slightly acid (pH 6.4); frozen on August 28, 1984

Typical Pedon Location

Map unit in which located: 426—Dadina-Klanelneechena complex, 0 to 2 percent slopes
Location in survey area: about 4 miles (6 km) west of Glennallen; about 100 feet (30 m) north and 2200 feet (670 m) east of the SW corner of section 30, T.4N., R.2W., Copper River Meridian

Range in Characteristics

Thickness of the organic mat: 8 to 13 inches (20 to 33 cm)
Depth to permafrost: 15 to 34 inches (38 to 86 cm) below the mineral surface

O horizon:
Reaction—moderately acid or slightly acid

A horizon:
Color—hue of 10YR or 2.5Y; value moist of 2 or 3; chroma moist of 1, 2, or 3
Texture—mucky silt loam or silt loam
Reaction—slightly acid or neutral

2C horizon:
Color—hue of 10YR or 2.5Y; value moist of 2 or 3; chroma moist of 1 or 2
Texture—coarse sand, sand, fine sand, or loamy fine sand
Reaction—slightly acid or neutral

Klawasi Series

Taxonomic class: clayey, mixed, nonacid Histic Pergelic Cryaquepts
Depth class: shallow to moderately deep (14 to 30 inches, or 36 to 76 cm) over permafrost
Drainage class: very poorly or poorly drained
Permeability: in the organic mat—moderately rapid; in the mineral soil—moderate; in the permafrost—impermeable
Position on landscape: broad lacustrine terraces
Parent material: thin silty loess mantle over clayey lacustrine deposits
Slope range: 0 to 20 percent
Elevation: 1100 to 2000 feet (335 to 610 m)
Climatic data (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
Other: Thawed counterparts of the Klawasi series in this survey area include the Gakona series.

Typical Pedon

Klawasi peat—on a 1 percent slope under black spruce forest at 1400 feet (426 m) elevation

Oi—9 to 4 inches (23 to 10 cm); dark reddish brown (5YR 3/2) peat; slightly decomposed moss and root fibers; clear wavy boundary
Oe—4 inches to 0 (10 cm to 0); black (5YR 2.5/1) mucky peat; partially decomposed moss and root fibers; abrupt smooth boundary
A—0 to 2 inches (0 to 5 cm); very dark gray (7.5YR 3/1) moist mucky silt loam; weak fine subangular blocky structure; very friable, slightly sticky and slightly plastic; many very fine and fine roots; neutral (pH 7.0); abrupt smooth boundary
AB—2 to 4 inches (5 to 10 cm); dark brown (7.5YR 3/2) moist silt loam; weak fine subangular blocky structure; very friable, slightly sticky and slightly plastic; many very fine and fine roots; neutral (pH 7.0); abrupt smooth boundary
2C—4 to 14 inches (10 to 36 cm); olive gray (5Y 4/2) moist silty clay; strong very fine subangular blocky structure; firm, very sticky and very plastic; few very fine and fine roots; moderately alkaline (pH 8.2); abrupt smooth boundary
2Cf—14 to 24 inches (36 to 60 cm); olive gray (5Y 4/2) moist silty clay; moderately alkaline (pH 8.2); weakly effervescent with disseminated lime; frozen on August 23, 1983

Typical Pedon Location

Map unit in which located: 438—Klawasi peat, depressional, 0 to 2 percent slopes
Location in survey area: about 7 miles (11 km) south of Copper Center; about 300 feet (91 m) west of the NE corner of section 18, T.1N., R.1E., Copper River Meridian

Range in Characteristics

Thickness of the organic mat: 9 to 14 inches (23 to 36 cm)
Depth to clayey material: 1 to 7 inches (3 to 18 cm)
Depth to permafrost: 14 to 30 inches (36 to 76 cm) below the mineral surface
Thickness of solum: 2 to 7 inches (5 to 18 cm)

O horizon:
Reaction—moderately or slightly acid

A horizon:
Color—hue of 7.5YR or 10YR; value moist of 2 or 3; chroma moist of 1, 2, or 3
Texture—silt loam, mucky silt loam, or silt
Reaction—slightly acid to mildly alkaline

AB horizon (absent in many profiles):
Color—hue of 7.5YR or 10YR; value and chroma moist of 2, 3, or 4
Texture—silt loam, mucky silt loam, or silt
Reaction—slightly acid or neutral
Other—striations and lenses of organic material are common

2C horizon:
Color—hue of 2.5Y or 5Y; value moist of 4 or 5; chroma moist of 1 or 2
Texture—silty clay or clay
Rock fragments—0 to 20 percent; 0 to 10 percent cobble; 0 to 15 percent gravel
Reaction—mildly or moderately alkaline
Effervescence—slightly to strongly, disseminated lime more prevalent with depth

Klutina Series

Taxonomic class: coarse-loamy over sandy or sandy-skeletal, mixed, nonacid Typic Cryofluvents
Depth class: very deep (more than 60 inches or 152 cm)
Drainage class: well drained
Permeability: in the loamy surface layer—moderate; in the sand and gravel substratum—rapid
Position on landscape: floodplains and stream terraces
Parent material: stratified sandy and silty alluvium over sand and gravel alluvium
Slope range: 0 to 7 percent
Elevation: 600 to 1300 feet (183 to 396 m)
Climatic data (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)

Typical Pedon

Klutina very fine sandy loam—on a 1 percent slope under balsam poplar and white spruce forest at 950 feet (289 m) elevation
Oi—1 inch to 0 (3 cm to 0); dark reddish brown (5YR 3/2) peat; fibrous moss, roots, and twigs; abrupt smooth boundary
A—0 to 3 inches (0 to 8 cm); very dark grayish brown (2.5Y 3/2) moist very fine sandy loam, dark grayish brown (2.5Y 4/2) dry; weak medium subangular blocky structure; very friable, nonsticky and nonplastic; many very fine and fine roots; neutral (pH 7.0); clear smooth boundary
C1—3 to 12 inches (8 to 30 cm); dark grayish brown (2.5Y 4/2) moist silt loam, grayish brown (2.5Y 5/2) dry; stratified with lenses of very fine sandy loam, fine sandy loam, and sand; weak medium subangular blocky structure; loose, nonsticky and nonplastic; many very fine and fine roots; neutral (pH 7.0); abrupt smooth boundary
C2—12 to 25 inches (30 to 64 cm); very dark grayish brown (2.5Y 3/2) moist loamy fine sand, dark grayish brown (2.5Y 4/2) dry; stratified with loamy very fine sand, very fine sandy loam, and silt loam; single grain; loose, nonsticky and nonplastic; common very fine and fine roots; neutral (pH 7.0); clear wavy boundary
2C—25 to 60 inches (64 to 152 cm); very dark grayish brown (2.5Y 3/2) moist very gravelly sand, dark grayish brown (2.5Y 4/2) dry; stratified with lenses and pockets of very fine sand, fine sand, and loamy fine sand; single grain; loose, nonsticky and nonplastic; 30 percent gravel and 15 percent cobble; lime coatings on undersides of coarse fragments; mildly alkaline (pH 7.8)

Typical Pedon Location

Map unit in which located: 449—Klutina-Klutina, rarely flooded complex, 0 to 2 percent slopes
Location in survey area: about 9 miles (14 km) northeast of Glennallen; about 2100 feet (640 m) north and 1800 feet (549 m) east of the SW corner of section 15, T.5N., R.1W., Copper River Meridian

Range in Characteristics

Thickness of the organic mat: 1 to 5 inches (3 to 13 cm)
Depth to sand and gravel: 12 to 29 inches (30 to 74 cm)

A horizon:
Color—hue of 10YR or 2.5Y; value moist of 2, 3, or 4; chroma moist of 1, 2, or 3
Texture—very fine sandy loam, fine sandy loam, or silt loam
Reaction—slightly acid or neutral

C horizon:
Color—hue of 10YR, 2.5Y, or 5Y; value moist of 2, 3, or 4; chroma moist of 1 or 2
Texture—stratified sandy loam, silt loam, or loamy sand
Reaction—slightly acid or neutral

2C horizon:
Color—hue of 10YR, 2.5Y, or 5Y; value moist of 2, 3, or 4; chroma moist of 1 or 2
Texture—sand or sandy loam
Rock fragments—40 to 70 percent; 35 to 45 percent gravel; 5 to 25 percent cobble
Reaction—neutral to moderately alkaline
Effervescence—weakly to strongly

Kuslina Series

Taxonomic class: loamy, mixed, nonacid Histic Pergelic Cryaquepts
Depth class: very shallow to shallow (5 to 14 inches, or 12 to 36 cm) over permafrost
Drainage class: very poorly or poorly drained
Permeability: in the organic mat and mineral soil—moderately rapid; in the permafrost—impermeable
Position on landscape: stream terraces
Parent material: thin silty loess mantle over stratified loamy and sandy alluvium
Slope range: 0 to 7 percent
Elevation: 600 to 1500 feet (183 to 457 m)
Climatic data (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)

Typical Pedon

Kuslina peat—on a 2 percent slope under dwarf black spruce forest at 1000 feet (304 m) elevation

Oi—10 to 3 inches (25 to 8 cm); dark brown (7.5YR 4/2) peat; raw fibrous moss, twigs, and root fibers; gradual smooth boundary
Oe—3 inches to 0 (8 cm to 0); very dark brown (10YR 2/2) mucky peat; partially decomposed moss, twigs, and root fibers; abrupt smooth boundary
A—0 to 4 inches (0 to 10 cm); very dark brown (10YR 2/2) moist silt loam; weak medium subangular blocky structure; very friable, nonsticky and nonplastic; lenses of black (10YR 2/1) mucky silt loam; many very fine, fine, and medium roots; neutral (pH 7.0); clear smooth boundary
2C1—4 to 7 inches (10 to 18 cm); very dark grayish brown (2.5Y 3/2) moist fine sandy loam; weak thin platy structure; friable, slightly sticky and slightly plastic; common very fine, fine, and medium roots; neutral (pH 7.2); clear wavy boundary
2C2—7 to 11 inches (18 to 28 cm); very dark grayish brown (2.5Y 3/2) moist very fine sandy loam; weak medium subangular blocky structure; very friable, nonsticky and nonplastic; thin strata of loamy fine sand and sand; few fine roots; neutral (pH 7.2); abrupt smooth boundary
2C2f—11 to 21 inches (28 to 53 cm); very dark grayish brown (2.5Y 3/2) moist fine sandy loam; thin strata of sand, fine sand, and loamy sand; occasional pebbles present; frozen on August 14, 1983

Typical Pedon Location

Map unit in which located: 452—Kuslina peat, 0 to 2 percent slopes
Location in survey area: about 7 miles (11 km) northwest of Kenny Lake; about 300 feet (91 m) south and 900 feet (274 m) east of the NW corner of section 3, T.1N., R.2E., Copper River Meridian

Range in Characteristics

Thickness of the organic mat: 8 to 16 inches (20 to 40 cm)
Depth to permafrost: 5 to 14 inches (12 to 36 cm) below the mineral surface

O horizon:
Reaction—strongly acid to moderately acid

A horizon:
Color—hue of 7.5YR or 10YR; value moist of 1 or 2; chroma moist of 2 or 3
Texture—silt loam, silt, or very fine sandy loam
Reaction—neutral to moderately alkaline

2C horizon:
Color—hue of 10YR, 2.5Y, or 5Y; value moist of 3 or 4; chroma moist of 1 or 2
Texture—stratified very fine sandy loam, fine sandy loam, sandy loam, silt loam, and loamy fine sand
Rock fragments—0 to 5 percent gravel
Reaction—neutral to moderately alkaline

Mendeltna Series

Taxonomic class: loamy, mixed, nonacid Histic Pergelic Cryaquepts
Depth class: shallow to moderately deep (14 to 29 inches, or 36 to 74 cm) over permafrost
Drainage class: very poorly or poorly drained
Permeability: in the organic mat—moderately rapid; in the mineral soil—moderate; in the permafrost—impermeable
Position on landscape: broad lacustrine terraces
Parent material: thin silty loess mantle over loamy lacustrine deposits
Slope range: 0 to 7 percent

Elevation: 1400 to 2200 feet (427 to 671 m)
Climatic data (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
Other: A thawed counterpart of the Mendeltna series in this survey area is the Chetaslina series.

Typical Pedon

Mendeltna peat—on a 2 percent slope under black spruce forest at 1600 feet (487 m) elevation

Oi—9 to 4 inches (23 to 10 cm); dark reddish brown (5YR 3/2) peat; raw fibrous moss and root fibers; gradual smooth boundary
Oe—4 inches to 0 (10 cm to 0); black (5YR 2.5/1) mucky peat; partially decomposed moss and root fibers; abrupt smooth boundary
A—0 to 2 inches (0 to 5 cm); very dark grayish brown (10YR 3/2) moist mucky silt loam; weak fine subangular blocky structure; very friable, slightly sticky and slightly plastic; many very fine, fine, and medium roots; neutral (pH 7.0); abrupt smooth boundary
2C—2 to 16 inches (5 to 40 cm); olive gray (5Y 4/2) moist gravelly clay loam; massive; firm, sticky and plastic; 25 percent gravel and 5 percent cobble; few very fine and fine roots; mildly alkaline (pH 7.4); abrupt smooth boundary
2Cf—16 to 26 inches (40 to 65 cm); olive gray (5Y 4/2) moist gravelly clay loam; 25 percent subangular gravel; weakly effervescent; disseminated lime; mildly alkaline (pH 7.8); frozen on August 23, 1983

Typical Pedon Location

Map unit in which located: 454—Mendeltna peat, 0 to 7 percent slopes
Location in survey area: about 10 miles (16 km) west of Glennallen; about 800 feet (244 m) north and 1200 feet (366 m) east of the SW corner of section 18, T.4N., R.3W., Copper River Meridian

Range in Characteristics

Thickness of the organic mat: 8 to 14 inches (20 to 36 cm)
Depth to permafrost: 14 to 29 inches (36 to 74 cm) below the mineral surface

Depth to loamy lacustrine material: 1 to 8 inches (3 to 20 cm)

O horizon:
Reaction—strongly acid or moderately acid

A horizon:
Color—hue of 7.5YR or 10YR; value moist of 2 or 3; chroma moist of 1, 2, or 3
Texture—mucky silt loam, silt loam, or silt
Reaction—neutral or mildly alkaline
Other—color striations due to variable organic matter content

2C horizon:
Color—hue of 10YR, 2.5Y, or 5Y; value moist of 4 or 5; chroma moist of 1 or 2
Texture—loam, clay loam, or silty clay loam
Rock fragments—5 to 30 percent; 0 to 30 percent gravel; 0 to 10 percent cobble
Reaction—mildly alkaline or moderately alkaline
Effervescence—none to slightly

Nizina Series

Taxonomic class: sandy-skeletal, mixed Typic Cryorthents
Depth class: very deep (more than 60 inches or 152 cm)
Drainage class: excessively drained
Permeability: in the surface material—moderately rapid; in the sand and gravel—rapid
Position on landscape: low stream terraces and floodplains
Parent material: thin layer of silty loess and sandy alluvium over gravelly and cobbly alluvium
Slope range: 0 to 5 percent
Elevation: 600 to 1500 feet (183 to 457 m)
Climatic data (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)

Typical Pedon

Nizina loamy fine sand—on a 2 percent slope under scattered white spruce and balsam poplar at 750 feet (228 m) elevation

Oi—1 inch to 0 (3 cm to 0); dark brown (7.5YR 3/2) peat; forest litter of leaves, twigs, and raw moss; abrupt smooth boundary; horizon is intermittent with exposed cobble comprising 20 percent of the soil surface

A—0 to 4 inches (0 to 10 cm); very dark grayish brown (10YR 3/2) moist loamy fine sand; single grain; loose, nonsticky and nonplastic; many roots of all sizes; neutral (pH 7.2); abrupt wavy boundary
2C1—4 to 14 inches (10 to 36 cm); dark olive gray (2.5Y 3/2) moist extremely gravelly sand with strata

and lenses of sand and fine sand; single grain; loose, nonsticky and nonplastic; common very fine and fine roots; 45 percent rounded gravel and 20 percent cobble; undersides of coarse fragments weakly calcareous with occasional thin lime coatings; neutral (pH 7.2); clear wavy boundary

2C2—14 to 23 inches (36 to 58 cm); variegated extremely cobbly sand with pockets and lenses of fine sand and sand; dominant color is dark olive gray (2.5Y 3/2); single grain; loose, nonsticky and nonplastic; few very fine and fine roots; 30 percent rounded gravel, 35 percent cobble, and 10 percent stones; undersides of coarse fragments weakly calcareous with occasional thin lime coatings; mildly alkaline (pH 7.8); gradual wavy boundary

2C3—23 to 60 inches (58 to 152 cm); variegated extremely cobbly sand with pockets and lenses of fine sand and sand; dominant color is dark olive gray (2.5Y 3/2); single grain; loose, nonsticky and nonplastic; 50 percent well rounded gravel and 30 percent cobble; undersides of coarse fragments are weakly calcareous with occasional lime coatings; mildly alkaline (pH 7.8)

Typical Pedon Location

Map unit in which located: 451—Klutina-Nizina complex, 0 to 2 percent slopes

Location in survey area: about 9 miles (14 km) east of Kenny Lake; about 1300 feet (396 m) south and 1500 feet (457 m) east of the NW corner of section 16, T.2S., R.4E., Copper River Meridian

Range in Characteristics

Thickness of the organic mat: 0 to 3 inches (0 to 8 cm)

Depth to gravelly and cobbly material: 2 to 8 inches (5 to 20 cm)

A horizon:

Color—hue of 10YR or 2.5Y; value moist of 2 or 3; chroma moist of 1 or 2

Texture—silt loam, very fine sandy loam, fine sandy loam or loamy fine sand

Rock fragments—0 to 5 percent rounded cobble and gravel

Reaction—neutral or mildly alkaline

2C horizon:

Color—hue of 10YR, 2.5Y, or 5Y; value moist of 1, 2, or 3; chroma moist of 2, 3, or 4

Texture—sand or fine sand, often stratified

Rock fragments—40 to 75 percent rounded gravel and cobble

Reaction—neutral to moderately alkaline

Effervescence—slightly to strongly on undersides of coarse fragments

Pippin Series

Taxonomic class: sandy-skeletal, mixed Typic Cryochrepts

Depth class: very deep (more than 60 inches or 152 cm)

Drainage class: somewhat excessively drained

Permeability: in the silty loess mantle—moderate; below this—rapid

Position on landscape: broad lacustrine terraces and till plains

Parent material: thin silty loess mantle over gravelly and cobbly glacial outwash deposits

Slope range: 0 to 45 percent

Elevation: 1400 to 2200 feet (427 to 671 m)

Climatic data (average annual):

*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)

*air temperature—26 °F (-3 °C)

Typical Pedon

Pippin silt loam—on a 1 percent slope under quaking aspen forest at 1000 feet (304 m) elevation

Oi—1 inch to 0 (3 cm to 0); dark brown (7.5YR 3/2) peat; fibrous roots, twigs, and leaf litter; clear smooth boundary

A—0 to 2 inches (0 to 5 cm); very dark brown (10YR 2/2) moist silt loam; weak medium subangular blocky structure parting to moderate fine granular; very friable, nonsticky and nonplastic; many very fine and fine and occasional medium roots; neutral (pH 6.8); clear smooth boundary

Bw—2 to 8 inches (5 to 20 cm); dark brown (10YR 3/3 and 10YR 4/3) moist silt loam; moderate medium subangular blocky structure; very friable, nonsticky and nonplastic; many very fine, fine, and medium roots; neutral (pH 6.8); abrupt wavy boundary

2C1—8 to 26 inches (20 to 66 cm); dark grayish brown (10YR 4/2) extremely gravelly sand; single grain; loose, nonsticky and nonplastic; common very fine and fine roots; neutral (pH 7.2); 45 percent rounded pebbles and 15 percent rounded cobbles; diffuse irregular boundary

2C2—26 to 60 inches (66 to 152 cm); dark grayish brown (10YR 4/2) moist extremely cobbly sand; single grain; loose, nonsticky and nonplastic; 40 percent rounded pebbles and 30 percent rounded cobbles with occasional thin lime coatings on undersides; mildly alkaline (pH 7.4)

Typical Pedon Location

Map unit in which located: 459—Pippin silt loam, 0 to 12 percent slopes

Location in survey area: about 10 miles (16 km) southeast of Copper Center; about 1900 feet (579 m) north and 2100 feet (640 m) east of the SW corner of section 19, T.1N., R.2E., Copper River Meridian

Range in Characteristics

Thickness of the organic mat: 1 to 4 inches (2 to 10 cm)
Depth to sand and gravel: 3 to 9 inches (8 to 23 cm)
Thickness of solum: 3 to 9 inches (8 to 23 cm)

O horizon:
Reaction—strongly acid to slightly acid

A horizon:
Color—hue of 7.5YR or 10YR; value moist of 2, 3, or 4; chroma moist of 1, 2, or 3
Texture—silt loam, silt, or very fine sandy loam

Bw horizon:
Color—hue of 5YR, 7.5YR, or 10YR; value moist of 3 or 4; chroma moist of 3 or 4
Texture—silt loam, silt, or very fine sandy loam
Rock fragments—0 to 5 percent gravel and cobble
Reaction—slightly acid to mildly alkaline

2C horizon:
Color—hue of 10YR, 2.5Y, or 5Y; value moist of 3 or 4; chroma moist of 1 or 2
Texture—sand or loamy sand
Rock fragments—45 to 80 percent; 40 to 75 percent gravel; 5 to 20 percent cobble
Reaction—neutral to moderately alkaline

Strelna Series

Taxonomic class: loamy, mixed Pergelic Cryoborolls
Depth class: very shallow (0 to 10 inches, or 0 to 25 cm) over permafrost
Drainage class: well drained
Permeability: in the organic mat—moderately rapid; in the mineral soil—moderate; in the permafrost—impermeable
Position on landscape: hills

Microtopography: back slopes and shoulder slopes
Parent material: silty loess deposits
Slope range: 20 to 45 percent
Elevation: 800 to 2100 feet (244 to 640 m)
Climatic data (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)

Other: The thawed counterpart to the Strelna series is Taral series.

Typical Pedon

Strelna peat—on a 32 percent slope under white spruce forest at 1800 feet (548 m) elevation

Oi—13 to 4 inches (33 to 10 cm); very dark brown (10YR 2/2) peat; slightly decomposed moss, twigs, and root fibers; thin horizontal lenses of grayish brown (2.5YR 4/2) silt loam; gradual smooth boundary
Oa/A—4 inches to 0 (10 cm to 0); black (10YR 2/1) highly decomposed organic material with streaks and patches of very dark brown (10YR 2/2) and dark brown (10YR 3/3) moist mucky silt loam; weak fine platy structure; very friable, nonsticky and nonplastic; many roots of all sizes; neutral (pH 6.8); clear smooth boundary
A/C1—0 to 10 inches (0 to 25 cm); very dark brown (10YR 2/2) moist mucky silt loam; weak medium subangular blocky structure separating horizontally along prominent color bands; streaks and patches of black (10YR 2/1) and dark brown (10YR 3/3); very friable, nonsticky and nonplastic; neutral (pH 6.8); abrupt wavy boundary
ACf—10 to 20 inches (25 to 50 cm); very dark brown (10YR 2/2) moist mucky silt loam; streaks and patches of black (10YR 2/1) and dark brown (10YR 3/3); frozen on August 10, 1983

Typical Pedon Location

Map unit in which located: 464—Strelna-Hanagita-Copper River complex, 15 to 55 percent slopes
Location in survey area: about 11 miles (18 km) east of Chitina; about 1000 feet (305 m) north and 400 feet (122 m) east of the SW corner of section 16, T.4S., R.7E., Copper River Meridian

Range in Characteristics

Thickness of the organic mat: 8 to 16 inches (20 to 40 cm)
Depth to permafrost: 0 to 10 inches (0 to 25 cm) below the mineral surface

Oa/A horizon:
Color—hue of 7.5YR or 10YR; value moist of 2, 3, or 4; chroma moist of 1, 2, or 3
Reaction—strongly acid to neutral

A horizon (when present):
Color—hue of 7.5YR or 10YR; value moist of 2, 3, or 4; chroma moist of 1, 2, or 3

Texture—muck, mucky silt loam, or mucky silt in darker strata and silt loam, silt, and very fine sandy loam in lighter strata
Reaction—slightly acid or neutral

A/C horizon:
Color—hue of 7.5YR or 10YR; value moist of 2, 3, or 4; chroma moist of 1, 2, or 3
Texture—silt loam, mucky silt loam, silt, or very fine sandy loam
Reaction—neutral or mildly alkaline
Other—stratas of decomposed organic material often present

Stuck Series

Taxonomic class: sandy over clayey, mixed Aquic Cryoborolls
Depth class: very deep (more than 60 inches or 152 cm)
Drainage class: somewhat poorly drained
Permeability: in the silty loess mantle—moderate; in the sandy substratum material—rapid; in the clayey substratum material—moderately slow
Position on landscape: broad lacustrine terraces
Microtopography: drainages and depressions
Parent material: silty loess overlying alluvium underlain by lacustrine clays
Slope range: 0 to 2 percent
Elevation: 1100 to 1600 feet (274 to 488 m)
Climatic data (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
Other: Stuck series is a thawed counterpart of the permafrost Klanelneechena series.

Typical Pedon

Stuck silt loam—on a 2 percent slope under forest vegetation at 1200 feet (365 m) elevation

Oi—3 inches to 0 (8 cm to 0); dark reddish brown (5YR 3/2) moist slightly decomposed moss, twigs, and root fibers; abrupt smooth boundary

A—0 to 2 inches (0 to 5 cm); very dark brown (10YR 2/2) moist silt loam, grayish brown (10YR 5/2) dry; moderate thin platy structure; very friable, nonsticky and nonplastic; many roots of all sizes; neutral (pH 7.0); clear wavy boundary
2C1—2 to 22 inches (5 to 56 cm); very dark brown (2.5YR 3/2) moist sand, grayish brown (2.5Y 5/2) dry; single grain; loose, nonsticky and nonplastic; pockets of very dark gray (10YR 3/1) few very fine and fine roots; neutral (pH 7.0); abrupt wavy boundary
3C2—22 to 34 inches (56 to 86 cm); dark grayish brown (2.5Y 4/2) moist clay; strong coarse granular structure; firm, very sticky and very plastic; mildly alkaline (pH 7.8); gradual wavy boundary
3C3—34 to 60 inches (86 to 152 cm); dark grayish brown (2.5Y 4/2) moist clay; moderate coarse granular structure; firm, very sticky and very plastic; common distinct dark yellowish brown (10YR 4/4) mottles; slightly effervescent; moderately alkaline (pH 8.0)

Typical Pedon Location

Map unit in which located: 446—Gakona-Stuck complex, 0 to 2 percent slopes
Location in survey area: about 7 miles (10 km) south of Copper Center; about 1400 feet (427 m) north of the SE corner of section 20, T.1N., R.1E., Copper River Meridian

Range in Characteristics

Thickness of the organic mat: 2 to 6 inches (5 to 15 cm)
Depth to sandy substratum: 1 to 5 inches (3 to 15 cm)
Depth to clayey substratum: 16 to 37 inches (41 to 94 cm)

A horizon:
Color—hue of 7.5YR or 10YR; value moist of 2 or 3; chroma moist of 1, 2, or 3
Texture—silt loam, silt, or mucky silt loam
Reaction—slightly acid or neutral.

2C horizon:
Color—hue of 2.5Y or 5Y; value moist of 2, 3, or 4; chroma moist of 1, 2, or 3
Texture—fine sand, sand, coarse sand, or loamy fine sand
Reaction—slightly acid or neutral

3C horizon:
Color—hue of 2.5Y or 5Y; value moist of 4 or 5; chroma moist of 1 or 2

Texture—silty clay loam, clay loam, silty clay, or clay
Coarse fragments—0 to 30 percent subangular cobble and gravel; 0 to 30 percent gravel; 0 to 15 percent cobble
Effervescence—slightly or noneffervescent
Reaction—mildly alkaline or moderately alkaline

Taral Series

Taxonomic class: coarse-loamy, mixed Pachic Cryoborolls
Depth class: very deep (more than 60 inches or 152 cm)
Drainage class: well drained
Permeability: moderate
Position on landscape: hills
Parent material: silty loess overlying glacial till
Slope range: 20 to 45 percent
Elevation: 1000 to 2200 feet (305 to 670 m)
Climatic data (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
Other: Taral is a thawed counterpart of the permafrost Strelna series.

Typical Pedon

Taral mucky silt loam—on a 22 percent slope under aspen forest at 1400 feet (426 m) elevation

Oi—2 inches to 0 (5 cm to 0); black (10YR 2/1) peat consisting of an undecomposed mat of roots, moss, leaves, and other forest litter; abrupt smooth boundary
A1—0 to 2 inches (0 to 5 cm); black (10YR 2/1) mucky silt loam; weak fine subangular blocky structure parting to weak thin platy; many roots of all sizes; neutral (pH 6.6); clear smooth boundary
A2—2 to 8 inches (5 to 20 cm); very dark brown (10YR 2/2) mucky silt loam with streaks and patches of black (10YR 2/1); weak fine subangular blocky structure parting to weak medium platy; many roots of all sizes; neutral (pH 6.6); clear wavy boundary
A/C—8 to 22 inches (20 to 55 cm); frost churned very dark brown (10YR 2/2), very dark grayish brown (10YR 3/2), dark yellowish brown (10YR 4/4), and dark grayish brown (2.5Y 4/2) silt loam; weak coarse subangular blocky structure parting to weak medium platy; common very fine, fine, and medium roots; neutral (pH 6.6); diffuse wavy boundary
2C1—22 to 31 inches (55 to 77 cm); very dark grayish brown (2.5Y 3/2) cobbly sandy loam; weak medium platy structure; very friable, nonsticky and nonplastic; mildly alkaline (pH 7.6); 15 percent subrounded gravel and 10 percent subrounded cobble; gradual wavy boundary
2C2—31 to 52 inches (77 to 130 cm); dark grayish brown (2.5Y 4/2) gravelly sandy loam; weak medium platy structure; very friable, nonsticky and nonplastic; mildly alkaline (pH 7.4); 15 percent subrounded gravel and 5 percent subrounded cobble; gradual smooth boundary
2C3—52 to 60 inches (130 to 150 cm); dark grayish brown (2.5Y 4/2) gravelly sandy loam; massive; very friable; nonsticky and nonplastic; mildly alkaline (pH 7.4); 20 percent subrounded gravel and 10 percent subrounded cobble

Typical Pedon Location

Map unit in which located: 463—Taral-Hanagita complex, 12 to 35 percent slopes
Location in survey area: about 10 miles (16 km) northwest of Chitina; about 2500 feet (762 m) south and 1500 feet (457 m) east of the NE corner of section 19, T.2S., R.5E., Copper River Meridian

Range in Characteristics

Depth to glacial till: 15 to 38 inches (38 to 97 cm)
Reaction: slightly acid to neutral in the upper horizons, ranging to moderately alkaline in the till substratum.

A horizon:
Color—hue of 7.5YR or 10YR; value moist of 2 or 3; chroma moist of 1, 2, or 3
Texture—silt loam, mucky silt loam, silt, or very fine sandy loam
Reaction—slightly acid or neutral
Other—colors occur in convoluted streaks and patches

2C horizon:
Color—hue of 2.5Y or 5Y; value moist of 3, 4, or 5; chroma moist of 1 or 2
Texture—loam, sandy loam, and fine sandy loam
Rock fragment content—0 to 30 percent subangular cobble and gravel; 0 to 25 percent gravel; 0 to 15 percent cobble
Reaction—neutral to moderately alkaline

Tebay Series

Taxonomic class: coarse-loamy, mixed Typic Cryochrepts
Depth class: very deep (more than 60 inches or 152 cm)
Drainage class: well drained
Permeability: moderate
Position on landscape: drumlins, moraines, and till plains
Parent material: thin mantle of loess over loamy glacial till
Slope range: 0 to 20 percent
Elevation: 1400 to 2200 feet (427 to 670 m)
Climatic data (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)

*air temperature—26 °F (-3 °C)

Typical Pedon

Tebay silt loam—on a 2 percent slope under white spruce and quaking aspen forest at 1600 feet (487 m) elevation

Oi—4 inches to 0 (10 cm to 0); dark reddish brown (5YR 3/2) peat; fibrous moss, twigs, and root fibers; abrupt smooth boundary

A—0 to 1 inch (0 to 2 cm); black (10YR 2/1) moist silt loam; weak fine granular structure; very friable, nonsticky and nonplastic; many very fine, fine, and medium roots; neutral (pH 6.6); abrupt smooth boundary

Bw—1 to 4 inches (2 to 10 cm); dark brown (7.5YR 3/4) moist silt loam; weak fine granular structure; very friable, nonsticky and nonplastic; few medium, distinct, yellowish brown (10YR 5/4) mottles; common fine and medium, few coarse roots; neutral (pH 6.8); diffuse irregular boundary

2CB—4 to 8 inches (10 to 20 cm); dark grayish brown (10YR 4/2) moist loam; weak fine granular structure; very friable, nonsticky and nonplastic; common medium, distinct, dark brown (10YR 3/3) patches of silt loam; common fine and medium, few coarse roots; 5 percent subrounded gravel; neutral (pH 7.2); diffuse irregular boundary

2C1—8 to 13 inches (20 to 33 cm); dark grayish brown (2.5Y 4/2) moist loam; weak fine granular structure; very friable, nonsticky and nonplastic; common medium distinct yellowish brown (10YR 5/4) mottles; few fine and medium roots; 10 percent subangular gravel; mildly alkaline (pH 7.4); clear smooth boundary

2C2—13 to 47 inches (33 to 119 cm); olive gray (5Y 4/2) and dark gray (5Y 4/1) fine sandy loam; massive; very friable, nonsticky and nonplastic; 10 percent subangular gravel; mildly alkaline (pH 7.8); gradual smooth boundary

2C3—47 to 60 inches (119 to 152 cm); olive gray (5Y 4/2) moist fine sandy loam; massive; very friable, nonsticky and nonplastic; 15 percent subangular gravel; mildly alkaline (pH 7.8)

Typical Pedon Location

Map unit in which located: 465—Tebay silt loam, 0 to 7 percent slopes

Location in survey area: about 8 miles (13 km) south of Copper Center; about 1800 feet (549 m) north and 2000 feet (610 m) east of the SW corner of section 24, T.1N., R.1W., Copper River Meridian

Range in Characteristics

Thickness of the organic mat: 2 to 5 inches (5 to 13 cm)

Depth to glacial till: 1 to 8 inches (2 to 20 cm)

Thickness of solum: 3 to 8 inches (8 to 20 cm)

A horizon:

Color—hue of 7.5YR or 10YR; value moist of 2 or 3; chroma moist of 1, 2, or 3

Texture—mucky silt loam, silt loam, or silt

Reaction—slightly acid or neutral

Bw horizon:

Color—hue of 5YR, 7.5YR, or 10YR; value moist of 3, 4, or 5; chroma moist of 3 or 4

Texture—silt loam, silt, fine sandy loam, or loam

Rock fragments—0 to 25 percent; 0 to 25 percent gravel; 0 to 10 percent cobble

Reaction—slightly acid or neutral

2C horizon:

Color—hue of 10YR, 2.5Y, or 5Y; value moist of 3 or 4; chroma moist of 1 or 2

Texture—loam, fine sandy loam, or sandy loam

Rock fragments—5 to 30 percent; 5 to 30 percent gravel; 0 to 10 percent cobble

Reaction—neutral or mildly alkaline

Tolsona Series

Taxonomic class: loamy, mixed, nonacid Histic Pergelic Cryaquepts

Depth class: shallow to moderately deep (14 to 26 inches, or 36 to 66 cm) over permafrost

Drainage class: very poorly or poorly drained

Permeability: in the organic mat—moderately rapid; in the mineral soil—moderate; in the permafrost—impermeable

Position on landscape: till plains

Parent material: thin loess mantle over loamy glacial till

Slope range: 0 to 12 percent

Elevation: 1300 to 2200 feet (396 to 670 m)

Climatic data (average annual):

*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)

*air temperature—26 °F (-3 °C)

Other: A thawed counterpart of the Tolsona series in the survey area is the Tsana series.

Typical Pedon

Tolsona peat—on a 5 percent slope under black spruce forest at 1700 feet (518 m) elevation

Oi—8 to 4 inches (20 to 10 cm); dark reddish brown (5YR 2.5/2) peat, consisting of raw fibrous moss, twigs, and root fibers; clear smooth boundary
Oe—4 inches to 0 (10 cm to 0); black (10YR 2/2) mucky peat, consisting of partially decomposed moss, twigs, and root fibers; gradual smooth boundary
A—0 to 3 inches (0 to 8 cm); dark brown (10YR 3/3) and black (10YR 2/2) mucky silt loam; weak medium subangular blocky structure; very friable, nonsticky and nonplastic; common fine and very fine roots; neutral (pH 7.0); abrupt wavy boundary
2C1—3 to 17 inches (8 to 43 cm); dark grayish brown (2.5Y 4/2) moist gravelly loam; massive; very friable, slightly sticky and slightly plastic; common medium distinct dark yellowish brown (10YR 4/4) mottles; 20 percent gravel and 5 percent cobble; few fine and very fine roots; neutral (pH 7.2); gradual irregular boundary
2C2—17 to 24 inches; (43 to 61 cm); olive gray (5Y 5/2) moist gravelly sandy loam; massive; very friable, nonsticky and nonplastic; 20 percent gravel; mildly alkaline (pH 7.4); abrupt smooth boundary
2Cf—24 to 34 inches (61 to 86 cm); olive gray (5Y 5/2) moist gravelly sandy loam; common medium distinct olive gray (2.5Y 4/4) mottles; frozen on August 10, 1983

Typical Pedon Location

Map unit in which located: 469—Tolsona peat, 0 to 7 percent slopes
Location in survey area: about 10 miles (16 km) northeast of Chitina; about 700 feet (213 m) north and 300 feet (91 m) west of the SE corner of section 21, T.3S., R.7E., Copper River Meridian

Range in Characteristics

Thickness of the organic mat: 8 to 13 inches (20 to 33 cm)
Depth to glacial till: 1 to 8 inches (3 to 20 cm)
Depth to permafrost: 14 to 26 inches (36 to 66 cm) below the mineral surface

O horizon:
Reaction—moderately acid or slightly acid
A horizon:
Color—hue of 7.5YR or 10YR; value moist of 2, 3, or 4; chroma moist of 1, 2, or 3
Texture—mucky silt loam, silt loam, or very fine sandy loam
Rock fragments—0 to 5 percent cobble and gravel
Reaction—slightly acid or neutral

2C horizon:
Color—hue of 7.5YR, 10YR, or 2.5Y; value moist of 2, 3, 4, or 5; chroma moist of 1, 2, or 3
Texture—loam, fine sandy loam, or sandy loam
Rock fragments—5 to 30 percent; 0 to 30 percent gravel; 0 to 10 percent cobble
Reaction—neutral or mildly alkaline

Tonsina Series

Taxonomic class: coarse-loamy, mixed Cumulic Cryoborolls
Depth class: very deep (more than 60 inches or 152 cm)
Drainage class: well drained
Permeability: moderate
Position on landscape: drumlins, till plains, and hills
Parent material: silty loess overlying glacial till
Slope range: 0 to 20 percent
Elevation: 1000 to 2200 feet (305 to 670 m)
Climatic data (average annual):
*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)
*air temperature—26 °F (-3 °C)
Other: Tonsina series is a thawed counterpart of the permafrost Copper River series

Typical Pedon

Tonsina silt loam—on a 1 percent slope under aspen forest at 1400 feet (426 m) elevation

Oi—2 inches to 0 (5 cm to 0); undecomposed mat of roots, moss, leaves, and other forest litter; abrupt smooth boundary
A—0 to 2 inches (0 to 5 cm); very dark grayish brown (10YR 3/2) moist silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; soft, very friable, nonsticky and nonplastic; many roots of all sizes; neutral (pH 7.2); clear smooth boundary
Bw1—2 to 4 inches (5 to 10 cm); dark brown (7.5YR 3/2) moist silt loam, brown (7.5YR 5/4) dry; streaks and patches of brown (7.5YR 4/4); weak thin platy structure; soft, very friable, nonsticky and nonplastic; many very fine, fine, and medium roots; neutral (pH 7.2); clear wavy boundary
Bw2—4 to 16 inches (10 to 40 cm); dark brown (10YR 3/3) moist silt loam, grayish brown (10YR 5/2) dry; few medium faint streaks and patches of dark yellowish brown (10YR 3/4); moderate thin platy structure; slightly hard, friable, nonsticky and nonplastic; common very fine and fine roots; neutral (pH 7.2); abrupt broken boundary

2C1—16 to 19 inches (40 to 48 cm); very dark grayish brown (2.5Y 3/2) moist gravelly sandy loam; massive; very friable, nonsticky and nonplastic; few fine and very fine roots; mildly alkaline (pH 7.4); 15 to 20 percent gravel; abrupt broken boundary

2C2—19 to 35 inches (48 to 88 cm); dark gray (5Y 4/1) moist sandy loam; weak medium platy structure parting to weak fine subangular blocky; soft, very friable, nonsticky and nonplastic; few fine roots; moderately alkaline (pH 8.2); about 10 percent gravel, few subrounded cobbles; clear smooth boundary

2C3—35 to 54 inches (88 to 137 cm); dark gray (5Y 4/1) moist fine sandy loam; weak medium platy structure parting to weak fine subangular blocky; soft, very friable, nonsticky and nonplastic; few fine roots; moderately alkaline (pH 8.2); 5 to 10 percent gravel, few subrounded cobbles; clear smooth boundary

2C4—54 to 60 inches (137 to 152 cm); gray (5Y 5/1) moist fine sandy loam; massive; soft, very friable, nonsticky and nonplastic; moderately alkaline (pH 8.2)

Typical Pedon Location

Map unit in which located: 415—Tonsina silt loam, 0 to 2 percent slopes

Location in survey area: about 5 miles (8 km) northwest of Kenny Lake; about 2200 feet (671 m) east and 250 feet (76 m) north of the SW corner of section 5, T.1S., R.2E., Copper River Meridian

Range in Characteristics

Depth to glacial till: 15 to 33 inches (38 to 83 cm)

Reaction: slightly acid to neutral in the upper horizons, ranging to moderately alkaline in the till substratum

A horizon:

Color—hue of 7.5YR or 10YR; value moist of 2 or 3; chroma moist of 1, 2, or 3

Texture—silt loam, mucky silt loam, silt, or very fine sandy loam

Reaction—slightly acid or neutral

Other—colors occur in convoluted streaks and patches

Bw horizon (when present):

Color—hue of 7.5YR or 10YR; value moist of 3, 4, or 5; chroma moist of 2, 3, or 4

Texture—silt loam, silt, or very fine sandy loam

Reaction—neutral or mildly alkaline

2C horizon:

Color—hue of 2.5Y or 5Y; value moist of 3, 4, or 5; chroma moist of 1 or 2

Texture—loam, sandy loam, and fine sandy loam

Rock fragment content—0 to 30 percent subangular cobble and gravel; 0 to 25 percent gravel; 0 to 15 percent cobble

Reaction—neutral to moderately alkaline

Tsana Series

Taxonomic class: coarse-loamy, mixed, nonacid Typic Cryorthents

Depth class: very deep (more than 60 inches or 152 cm)

Drainage class: well drained

Permeability: moderate

Position on landscape: till plains

Parent material: thin loess mantle over loamy glacial till

Slope range: 0 to 20 percent

Elevation: 1300 to 2200 feet (396 to 670 m)

Climatic data (average annual):

*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)

*air temperature—26 °F (-3 °C)

Other: Tsana series is a thawed counterpart of the permafrost Tolsona series.

Typical Pedon

Tsana silt loam—on a 1 percent slope under white spruce forest at 1500 feet (457 m) elevation

Oi—2 inches to 0 (5 cm to 0); peat; undecomposed roots, mosses, and forest litter; abrupt wavy boundary

A—0 to 2 inches (0 to 5 cm); black (10YR 2/1) moist silt loam, light brownish gray (10YR 6/2) dry; weak very fine subangular blocky structure; loose, nonsticky and nonplastic; many roots of all sizes; neutral (pH 6.8); abrupt wavy boundary

Bw—2 to 3 inches (5 to 8 cm); brown (10YR 4/3) moist silt loam, light yellowish brown (10YR 6/4) dry; weak fine subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; many roots of all sizes; neutral (pH 7.0); clear wavy boundary

2C1—3 to 8 inches (8 to 20 cm); dark grayish brown (2.5Y 4/2) moist fine sandy loam, olive (5Y 5/3) moist; moderate thin platy structure parting to moderate very fine subangular blocky; soft, very friable, nonsticky and slightly plastic; common roots of all sizes; neutral (pH 7.0); clear wavy boundary

2C2—8 to 14 inches (20 to 36 cm); dark grayish brown (2.5Y 4/2) sandy loam with pockets about 3 inches (7 cm) in diameter of loamy sand and sand; weak thin platy structure parting to weak very fine subangular blocky; soft, very friable, nonsticky and

nonplastic; few roots; neutral (pH 7.0); clear wavy boundary

2C3—14 to 30 inches (36 to 76 cm); olive gray (5Y 4/2) moist fine sandy loam; weak thick platy structure; soft, very friable, nonsticky and nonplastic; very few roots in the upper few inches; 10 to 15 percent cobble and coarse gravel; mildly alkaline (pH 7.4); gradual wavy boundary.

2C4—30 to 60 inches (76 to 152 cm); olive gray (5Y 4/2) moist fine sandy loam; strong fine and very fine subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; 10 to 15 percent cobble and coarse gravel; mildly alkaline (pH 7.6)

Typical Pedon Location

Map unit in which located: 472—Tsana silt loam, thin surface, 0 to 7 percent slopes

Location in survey area: about 6 miles (10 km) east of Kenny Lake; about 1000 feet (305 m) west and 400 feet (122 m) south of the NE corner of section 7, T.2S., R.4E., Copper River Meridian

Range in Characteristics

Thickness of the organic mat: 1 to 5 inches (3 to 20 cm)

Depth to glacial till: 1 to 8 inches (3 to 20 cm)

A horizon:

Color—hue of 10YR or 2.5Y; value moist of 2, 3, or 4; chroma moist of 1, 2, or 3

Rock fragments—0 to 5 percent gravel

Reaction—slightly acid or neutral

Bw horizon (when present):

Color—hue of 7.5YR, 10YR, or 2.5Y; value moist of 2, 3, or 4; chroma moist of 2, 3, or 4

Texture—silt loam, silt, fine sandy loam, sandy loam, or loam

Rock fragments—0 to 5 percent gravel

Reaction—slightly acid to neutral

2C horizon:

Color—hue of 10YR, 2.5Y, or 5Y; value moist of 3, 4, or 5; chroma moist of 1 or 2

Texture—fine sandy loam, sandy loam, or loam

Rock fragments—0 to 30 percent subangular cobble and gravel

Reaction—neutral to mildly alkaline

Wrangell Series

Taxonomic class: Euic Pergelic Cryohemists

Depth class: shallow to moderately deep (14 to 38 inches, or 36 to 97 cm) over permafrost

Drainage class: very poorly drained

Permeability: in the organic mat—moderately rapid; in the mineral soil—moderately slow; in the permafrost—impermeable

Position on landscape: broad lacustrine terraces

Microtopography: muskegs and depressions

Parent material: organic materials over clayey lacustrine deposits

Slope range: 0 to 2 percent

Elevation: 900 to 2100 feet (274 to 640 m)

Climatic data (average annual):

*precipitation—12 inches (30 cm); range—8 to 17 inches (20 to 43 cm)

*air temperature—26 °F (-3 °C)

Typical Pedon

Wrangell peat—on an 8 percent slope under low shrubs, sedges, and grasses at 1000 feet (304 m) elevation

Oi—0 to 4 inches (0 to 10 cm); dark reddish brown (5YR 2.5/2) squeezed peat consisting of undecomposed sedges, roots, and ericaceous shrub fibers; 90 percent fibers unrubbed, 75 percent fibers rubbed; moderately acid (pH 6.0); clear irregular boundary

Oe—4 to 23 inches (10 to 58 cm); dark reddish brown (5YR 2.5/2) squeezed mucky peat consisting of partially decomposed sedges, roots, and ericaceous shrub fibers; 70 percent fiber unrubbed, 50 percent fiber rubbed; common very fine, fine, and medium roots; slightly acid (pH 6.2); abrupt wavy boundary

C1g—23 to 30 inches (58 to 76 cm); dark greenish gray (5GY 4/1) moist silty clay; massive; firm, very sticky and very plastic; common medium distinct dark yellowish brown (10YR 4/4) mottles; mildly alkaline (pH 7.6); gradual smooth boundary

C2g—30 to 37 inches (76 to 94 cm); olive gray (5Y 4/2) moist silty clay; massive; firm, very sticky and very plastic; common medium distinct dark greenish gray (5GY 4/1) mottles; moderately alkaline (pH 8.0); abrupt wavy boundary

Cf—37 to 47 inches (94 to 119 cm); olive gray (5Y 4/2) moist silty clay; moderately alkaline (pH 8.0); frozen August 22, 1984

Typical Pedon Location

Map unit in which located: 475—Wrangell peat, 0 to 2 percent slopes

Location in survey area: about 3 miles (5 km) southwest of Gakona; about 600 feet (183 m) south

and 300 feet (91 m) west of the NW corner of section 6, T.5N., R.1W., Copper River Meridian

Range in Characteristics

Thickness of the organic mat: 18 to 33 inches (46 to 84 cm)
Depth to mineral soil: 18 to 33 inches (46 to 84 cm)
Depth to permafrost: 14 to 38 inches (36 to 97 cm) below the mineral surface

O horizon:
Color—hue of 2.5YR, 5YR, 7.5YR, or 10YR; value moist of 2 or 2.5; chroma moist of 1 or 2
Reaction—moderately acid or slightly acid

C horizon:
Color—hue of 2.5Y, 5Y, 5GY, or 5G; value moist of 3, 4, or 5; chroma moist of 1, 2, or 3
Texture—clay, silty clay, silty clay loam, or clay loam
Rock fragments—0 to 20 percent cobble and gravel
Reaction—mildly alkaline or moderately alkaline

Formation of the Soils

Soil is the unconsolidated mineral and organic material on the surface of the earth that serves as a natural medium for the growth of land plants *(United States Department of Agriculture 1993)*. Because soil has been subjected to and influenced by numerous physical and chemical weathering processes, it differs from the material from which it was derived in many physical, chemical, and morphological properties and characteristics. Soil formation is also influenced by genetic and environmental factors of climate (including temperature and moisture effects), topography, parent material, and living organisms, all acting over a period of time. The influence of any one of these factors varies from place to place, but the interaction of all of them determines the kind of soil that forms.

Soil Temperature and Permafrost

The zonal climate of the Copper River basin is subarctic continental, and relatively uniform throughout the survey area. Winters are long and cold; daily low temperatures below -20 °F (-29 °C) are common for extended periods most winters. Mean annual air temperature is 26 °F (-3 °C). The cold climate characteristic of the basin contributes to low soil temperatures, weak soil development, and the occurrence of permafrost (perennially frozen ground) near the soil surface. The Copper River basin lies within the zone of discontinuous permafrost *(Péwé 1969),* and perennially frozen ground underlies most of the basin with the exception of lakes and floodplains.

Permafrost commonly occurs as finely segregated ice crystals and thin discontinuous ice lenses throughout the soil matrix. In clayey lacustrine deposits, ice content can average as high as 30 to 60 percent of the dry weight of the soil material *(Nichols 1956)*. Ground ice has been observed at a shallow depth in Copper River peat soils in the southeast portion of the survey area and probably occurs elsewhere and in other soils as well. Soils with extensive ground ice usually liberate large quantities of water if thawed. Dry permafrost, or perennially frozen soil which is devoid of visible ice and which does not yield excess water upon thawing, has been observed in all permafrost affected soils.

Area soils in which permafrost occurs within the soil profile include the Copper River, Dadina, Klanelneechena, Klawasi, Kuslina, Mendeltna, Strelna, Tolsona, and Wrangell soils. Because permafrost is impermeable to water, soil drainage is restricted and a perched water table often occurs above the permafrost. Saturated soil is susceptible to frost heaving during winter as a result of an increase in soil volume upon freezing. The magnitude of volume increase is commonly greater than would be expected from freezing of existing soil moisture because of migration of additional water into the freezing zone and the segregation of ice lenses *(Fahely 1974)*. The vertical expansion of a clayey soil with an abundant supply of moisture can be as much as 60 percent *(Viereck and Dyrness 1979)*. Repeated cycles of freezing and thawing favor the development of irregular surface microrelief, or hummocks, in soils with shallow permafrost and perched water tables. Convoluting and fracturing of soil horizons, which occurs during freezing and subsequent thawing, substantially reduces the degree of soil development.

Soil temperatures and the depth to permafrost vary considerably, depending to a large degree on the type of vegetation and thickness of the organic mat. An overall reduced rate and degree of organic matter decomposition is associated with the cold climate of the basin; as a result, organic matter tends to accumulate on the soil surface. In addition, forest succession is accompanied by the development of a thick layer of mosses on the forest floor. The combined moss and organic layer functions as an excellent insulator against changes in soil temperature throughout the year, most importantly, limiting the degree of soil warming during the summer. Under mature black, and often white, spruce forests, soils typically have a thick moss layer and thick organic surface horizon, and permafrost within 12 inches (30 cm) of the mineral surface. The difference between winter and summer soil temperature is less than 5 °F (3 °C). In contrast, in a cultivated field in the Kenny Lake area, the difference between winter and summer

soil temperature approaches 20 °F (11 °C) *(United States Department of Agriculture 1990)*.

Soil temperature data were collected in the Kenny Lake area between 1981 and 1985 from permafrost soils and their thawed counterparts on nearly level sites. The soils included the Copper River, Chitina, Kenny Lake, Tonsina, Gakona and Klawasi series. The data showed the following relationships between vegetation type, forest floor thickness, mean annual soil temperature, and depth to permafrost. Under mid- to late-successional white spruce forest with a thin moss layer and a surface organic horizon about 3 inches (8 cm) thick, mean annual soil temperature at a depth of 20 inches (50 cm) ranged from 30 to 32 °F (-1 to 0 °C). Permafrost was at 39 inches (100 cm). Under aspen forest with no moss layer and only 1 inch (2 cm) of organic material, mean annual soil temperature ranged from 30 to 34 °F (-1 to 1 °C) and permafrost was below 60 inches (152 cm). In a cultivated soil with no organic material on the surface, mean annual soil temperature ranged from 32 to 36 °F (0 to 2 °C) and permafrost was absent *(United States Department of Agriculture 1990)*.

Soil temperature and the occurrence of permafrost are also influenced by topography. Map unit 424—Cryorthents and Cryochrepts, 30 to 70 percent slopes provides an example of this relationship. Cryorthents, which occur on steep south facing escarpments, are warm, dry, and either barren or sparsely vegetated with xerophytic shrubs and herbs. Permafrost is absent within 60 inches (152 cm) on these slopes. Cryochrepts, which occur on steep north facing escarpments, typically support spruce forest with a thick forest floor of mosses and organic material. On these slopes, soils are usually cold with permafrost near the surface (Figure 10).

Since soil texture exerts some control over soil temperature *(Rieger 1983)*, the effect on permafrost occurrence varies depending on other site characteristics. In general, coarse textured soils, because of their high volume of pores or voids between soil particles which allows for more rapid air exchange, respond more quickly to changes in air temperature, warm more rapidly in spring, and thaw deeper in summer than finer textured soils. Coarse textured soils also exhibit a wider range between summer and winter soil temperatures than finer textured soils. For example, mean summer and winter soil temperatures in Klutina very fine sandy loam are 39 and 23 °F (3.9 and -5.0 °C), respectively. Gakona soils, which formed in clayey lacustrine deposits, have a mean summer temperature of 37 °F (2.8 °C) and mean winter temperature of 25 °F (-3.9 °C) *(United States Department of Agriculture 1990)*. The occurrence of a thick moss/organic layer on the soil surface and a shallow water table lessens the effect of texture on soil temperature.

Lastly, low soil temperatures inhibit chemical weathering processes. Primary weathering processes include oxidation and reduction, and alteration and translocation, of minerals. Plant and animal effects on soil weathering are also inhibited. Because these processes are effective only during warm summer months, soil profile development within the thawed soil surface occurs very slowly in cold climates. In permafrost, further soil weathering and profile development do not occur.

Fire History and Permafrost

As described in the preceding section, a key indicator of the depth to permafrost and associated soil drainage is vegetation, primarily forest type and thickness of the forest floor. Field observations from the Copper River Area and research elsewhere in Interior Alaska indicate that, as a result of wild fires and post-fire vegetative succession, extensive areas of upland permafrost soils cycle between a poorly drained, shallow permafrost state and a well drained, ice-free condition. Soils under mature black, and often white, spruce forests typically have a thick organic mat, permafrost near the mineral surface, and a water table perched above the impermeable permafrost. Soils elsewhere on similar landforms that have been impacted by fire often have only a thin organic layer, no permafrost, and are well drained. Soils in this survey area that alter between frozen, poorly drained and thawed, well drained states include the Copper River-Chitina soils, Kenny Lake-Tonsina soils, Klanelneechena-Stuck soils, Klawasi-Gakona soils, Mendeltna-Chetaslina soils, and Tolsona-Tsana soils.

Wild fires in the interior of Alaska tend to be high-intensity crown fires that typically kill and replace entire stands *(Viereck and Dyrness 1979)*. With the overstory removed, the forest floor blackened, and its insulative value reduced, the soil surface receives and absorbs increased solar radiation which is transferred as heat to the subsoil. If the fire was severe enough to consume the entire organic layer and expose mineral soil, the conduction of heat to the subsoil is more effective. Beginning immediately after the fire, and continuing for a number of years, increased soil temperatures promote thawing of the permafrost and an increase in the thickness of the active layer above the permafrost (Figure 11).

Observations from the Wilson Camp fire, which burned in July of 1981 on the east side of the Copper River, showed an increase in the depth of thaw the first year after the burn. Depth to permafrost in

August, in similar unburned forest adjacent to the burn, averaged 16 inches (40 cm) below the mineral surface. In August of 1982, within the burned area, depth to permafrost averaged 31 inches (80 cm) deep; in August of 1983, permafrost averaged 39 inches (100 cm) deep *(United States Department of Agriculture 1990)*. Similar observations have been made in the boreal forest near Fairbanks, Alaska. Viereck and Dyrness *(1979)* reported that, 5 years following fire in a black spruce forest, the thickness of the active layer increased from 16 inches (42 cm) to 43 inches (109 cm); after 8 years, the maximum depth of thaw was approximately 71 inches (180 cm). Dyrness *(1982)* reported that, 4 years after burning in the black spruce type, active layer thickness increased 3 fold when one-half of the organic surface was consumed by the fire and 5 fold when the entire surface was consumed and mineral soil exposed.

Depending on the amount of ice within the frozen ground, large quantities of water can be liberated as the permafrost melts. Initially, a rise in the depth of the water table often occurs. Depending on the rate at which the permafrost melts and the topography of the site, this increase is short lived and improved soil drainage develops as the permafrost level becomes deeper in the soil profile. Poorly drained conditions often persist on level or concave positions that lack external drainage outlets.

Although reinvasion of the permafrost with post-fire forest succession undoubtedly occurs, the time required to reach pre-burn depths is not well documented. It will depend, in part, on the depth of the organic layer consumed by the fire and the rate of revegetation *(Viereck and Dyrness 1979)*. Foote *(1976)* and Viereck (*1973*) agree that, in the black spruce type in interior Alaska, the forest canopy, forest floor, and active layer thickness return to their original state within 50 to 70 years following fire. As the canopy develops and, most importantly, as the moss/organic layer thickens, soil temperatures decrease and the permafrost level gradually rises.

If the soil is cultivated or the moss/organic layer periodically disturbed, a soil can remain in a well drained, permafrost-free state indefinitely.

Factors of Soil Formation

Landforms

Floodplains

Floodplains are nearly level alluvial plains that border the active river channels, and are subject to flooding during spring and summer run off and other episodes of high stream flow. Floodplains are the youngest landforms in the survey area. In general, floodplain soils are weakly developed due to the limited time for soil development and the periodic erosion of existing materials as a result of channel migration and deposition of new material from flood waters. The bar and channel microrelief characteristic of floodplains consists of ridge-like bars of coarse textured materials and intervening channels filled with finer textured materials. Elsewhere, floodplain deposits consist of irregularly bedded sandy, silty, and gravelly materials. Backswamps, which often form in abandoned channel areas between river bars and higher terraces, are filled with fine textured deposits and organic materials. Over time, erosion tends to fill channels and backswamps and microrelief becomes subdued. Along the Copper River, two dominant floodplain levels, separated by short, steep escarpments from one to three feet high, are evident. The small elevational difference between these two levels results in significant variation in the frequency and duration of flooding over short distances.

Soils on the floodplains include the Klutina and Nizina soils. These soils are formed in stratified silty and sandy alluvium of varying thickness over very cobbly and gravelly substrata. In both Klutina and Nizina soils, organic matter content is relatively low; however, black sand grains impart a dark color to the surface. Lime coatings are common on gravel and cobble in the substrata of both soils.

Vegetation on the lowest floodplain next to the active channel, which usually floods every year, consists of closed stands of alder and willow with an understory of horsetails and other herbs (Figure 3). This vegetation is well adapted to yearly flooding and quickly sends up new shoots through recently deposited alluvium. Higher floodplains, which receive significant overflow less often, support more diverse vegetation dominated by balsam poplar and white spruce. Alder, soapberry, horsetail, and a wide variety of herbs, lichens, and mosses are found in the understory, depending on stand age and degree of canopy closure.

Stream Terraces

Stream terraces are nearly level platforms separated by steep escarpments that border the river canyons immediately above the floodplains. Stream terraces, which represent the dissected remnants of historic floodplains, formed by the continuous downcutting of the Copper River through existing lacustrine and alluvial deposits. A step sequence of 5 matched terrace levels occurs on each side of the Copper River. Because of their elevation above the active channel, stream terraces are no longer subject to the effects of periodic flooding (Figure 12).

Stream terrace soils include the Gulkana and Kuslina soils. Gulkana soils are formed in a silty loess mantle over gravelly alluvium on upper terraces. The coarse textured substratum of Gulkana soils has a high volume of pore space that enables rapid air exchange, warm soil temperatures, and deep percolation of soil water. Compared to soils formed in similar materials on the floodplains, Gulkana soils are strongly developed with bright colored subsoil. White calcium and magnesium carbonate coatings occur on the underside of coarse fragments in the substratum. Vegetation on Gulkana soils is dominated by white spruce, aspen, and mixed white spruce-aspen forests. Willow shrub occurs where recently burned.

Kuslina soils, which occupy relic channel positions of the former floodplain, are formed in an admixture of silty loess and stratified silty and sandy alluvium. Kuslina soils have permafrost at a shallow depth and are poorly drained. They have a thick organic mat on the surface but are weakly developed otherwise. Vegetation on Kuslina soils is dominantly white spruce and black spruce forest.

The escarpments separating the various terrace levels are typically steep and from 20 to 200 feet (6 to 60 m) long. Old lacustrine sediments are exposed on barren areas of south facing escarpments. South facing escarpments are warm and dry, and either barren or sparsely vegetated with xerophytic shrubs and herbs. North facing escarpments are usually forested with black and white spruce. Between these extremes, vegetation varies widely depending on actual soil and site conditions (Figure 10).

Lacustrine Terraces

The highest and oldest terrace in the basin is the broad, nearly level lacustrine terrace, which occurs above the stream terraces on both sides of the Copper River. The lacustrine terrace, like the stream terraces, formed when the river downcut through the lacustrine sediments following the draining of the proglacial lake. The terrace represents the former lake bed.

The thickness of the lacustrine sediments varies considerably. In places along the Copper River, lacustrine materials 200 feet (60 m) or more thick are exposed in some escarpments. With increasing elevation, and towards the outer edge of the terrace, the thickness of the deposits gradually becomes thinner and, in places, old glacial moraines and drumlins protrude through the lacustrine deposits. The outer edge corresponds with the margin of the former lake. In general, the lacustrine deposits are clayey, although clay content gradually decreases with increasing elevation. The lacustrine sediments are high in calcium carbonate and have mildly to moderately alkaline reactions.

A layer of silty loess of varying thickness mantles much of the lacustrine terrace. The majority of the loess probably was deposited relatively rapidly following drainage of the lake, when floodplains were more extensive and the proximity of glaciers created strong proglacial winds. Loess deposits are thickest near the Copper River canyon and thin rapidly away from the River. In the southern portion of the survey area, thick deposits of loess occur for several miles away from the river. Loess deposition continues today, particularly in the vicinity of the confluence of the Copper and Chitina Rivers.

Permafrost at a shallow depth and poorly drained conditions are common but highly variable over short distances across the lacustrine terrace. Recurring wild fires have created a complex mosaic of permafrost states and soil drainage conditions. In most places across the lacustrine terrace, soils potentially alter between shallow permafrost and a permafrost-free state. In general, soils on the lacustrine terrace are weakly developed.

The principal lacustrine terrace soils include Copper River, Chitina, Kenny Lake, Tonsina, Klawasi, Gakona, Mendeltna and Stuck soils. Copper River soils formed in silty loess over various substratum materials. The three thawed counterparts of Copper River soil (Chitina, Kenny Lake, and Tonsina) reflect this variation in materials, which ranges from clayey lacustrine materials to silty loess to loamy glacial till. Klawasi soil and its thawed counterpart, Gakona, formed in clayey lacustrine deposits with only a thin layer of loess on the surface. In both Kenny Lake and Gakona soils, the strong, medium to coarse granular structure in the clayey subsoil developed as a result of flocculation of clay particles into aggregates. The presence of calcium carbonate in these lacustrine deposits facilitates the formation of strong soil aggregates. Moderate permeability rates are characteristic of these soils and are higher than the clay content would suggest. Mendeltna soil and its thawed counterpart, Chetaslina, which occur at somewhat higher elevations than Klawasi soils, are formed in lacustrine deposits with textures dominated by loam and clay loam and only a thin layer of loess on the surface.

Shallow depressions, which are presently filled with organic deposits of varying thickness or are occupied by clear water lakes and ponds, are common across the lacustrine terrace (Figure 13). Wrangell, Cryohemists, and Cryofibrists soils are formed in the thick organic deposits.

Vegetation across the lacustrine terrace is highly variable. Potential vegetation consists primarily of black and white spruce forest. In recently burned areas, willow shrub and aspen or mixed white spruce-aspen forests predominate. Willow and ericaceous

shrub occur on shallow drainages. Areas with high water tables border most lakes and ponds and support wet meadow vegetation.

Glacial Landforms

Glacial landforms dominate the landscape above the lacustrine terrace. Extensive, nearly level to undulating till plains, and low relief drumlins and moraines, originated as a result of glacial activity during the late Pleistocene (Figure 2). These landforms are composed of a variety of materials including loamy till and sandy and gravelly outwash and delta deposits. Till plains, because of overlap and intermixing of geologic materials and similarity of the terrain, frequently are indistinguishable from the lacustrine terrace. Steep hills of moderate relief, which originated from volcanic andesite flows from the Wrangell Mountains, are in the southeast portion of the survey area. These hills were scoured and rounded by glacial ice and smeared with loamy glacial till.

Similar to the lacustrine terrace, silty loess of varying thickness mantles most glacial landforms. Loess deposits are thickest in the southern portion of the survey area, where soils are often formed in stratified silty loess and organic materials.

The permafrost Copper River and Strelna soils, as well as their thawed counterparts, Chitina and Taral, formed in areas with a thick loess cap. Copper River and Chitina soils are found on undulating plains, and toe slopes and depressions between hills. Strelna and Taral soils are found on moderately steep to steep hillslopes. The thick organic surface and high organic content of the loess of these soils have promoted the formation of shallow permafrost. Unless recently burned, Copper River soils tend to be poorly drained with a water table perched above the permafrost. Strelna soils, because of steep slopes that promote the lateral down slope movement of water, do not have a perched water table.

Tolsona and Klanelneechena soils, and their thawed counterparts, Tsana and Stuck, formed on undulating plains, and on toeslopes and depressions between moraines and drumlins in areas where the loess cap is less than 8 inches (20 cm) thick. The substratum of Tolsona and Tsana soils is loamy glacial till. Klanelneechena and Stuck soils have a substratum of sandy glacial outwash with loamy till often occurring deeper in the soil. Unless recently burned, both Tolsona and Klanelneechena soils have permafrost at a shallow depth, are poorly drained, and often have a perched water table. Recurring wild fires have created a complex mosaic of permafrost states and soil drainage conditions. Tolsona and Klanelneechena soils potentially alter between shallow permafrost and a permafrost-free state.

Chistochina, Pippin, and Tebay soils occur in convex landscape positions on drumlins and moraines. These soils have only a thin loess mantle, coarse textured substratums, and are well to somewhat excessively drained. The convex landscape position and porous substratums of these soils favor warm soil temperatures in the summer, and all lack permafrost within the soil profile. Chistochina, Pippin, and Tebay soils are all relatively well developed with a brightly colored subsoil.

Vegetation on the glacial landforms is highly variable, depending in part on fire history but also on the kind of soil. On the permafrost Copper River, Tolsona, and Klanelneechena soils, potential vegetation consists primarily of black and white spruce forests. In recently burned areas, willow shrub, aspen forest, and mixed white spruce-aspen forests predominate. Paper birch is a common forest component in the southern portion of the area. The permafrost Strelna soils, which occur only in the southern end of the survey area, support old growth white spruce and mixed white spruce-paper birch forests. Few areas of Strelna soils exhibit any fire history, and white spruce greater than 200 years old and deteriorating stand conditions are common. Most areas of Chistochina, Pippin, and Tebay soils support aspen and mixed white spruce-aspen forests.

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Glossary

Active layer. The layer of ground above the permafrost which thaws and freezes annually.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Back slope. The geomorphic component that forms the steepest inclined surface and principal element of many hill slopes. Back slopes in profile are commonly steep and linear and descend to a foot slope. In terms of gradational process, back slopes are erosional forms produced mainly by mass wasting and running water.

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Basal area. The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.

Basal till. Compact glacial till deposited beneath the ice.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bedrock-controlled topography. A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

Bifurcation. Forked, or to divide into two branches.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Board foot. A unit of measure of the wood in lumber, logs, or trees. The amount of wood in a board one foot wide, one foot long, and one inch thick before finishing.

Boulders. Rock fragments larger than 2 feet (60 cm) in diameter.

Breast height. An average height of 4.5 feet above the ground surface; the point on a tree where diameter measurements are ordinarily taken.

Brush management. Use of mechanical, chemical, or biological methods to reduce or eliminate competition from woody vegetation and thus to allow understory grasses and forbs to recover or to make conditions favorable for reseeding. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

Cable yarding. A method of moving felled trees to a nearby central area for transport to a processing facility. Most cable yarding systems involve use of a drum, a pole, and wire cables in an arrangement similar to that of a rod and reel used for fishing. To reduce friction and soil disturbance, a felled tree generally is reeled in while one end is lifted or the entire log is suspended.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

California bearing ratio (CBR). The load-supporting capacity of a soil as compared to that of a standard crushed limestone, expressed as a ratio. First standardized in California. A soil having a CBR of 16 supports 16 percent of the load that would be supported by standard crushed limestone, per unit area, with the same degree of distortion.

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Canyon. A long, deep, narrow, very steep sided valley with high, precipitous walls in an area of high local relief.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Channeled. Refers to a drainage area in which natural meandering or repeated branching and convergence of a streambed have created deeply incised cuts, either active or abandoned, in alluvial material.

Channery soil material. Soil material that is, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chemical treatment. Control of unwanted vegetation by use of chemicals.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clayey soil. Silty clay, sandy clay, or clay.

Clearcut. A method of forest harvesting that removes the entire stand of trees in one cutting. Reproduction is achieved artificially or by natural seeding from adjacent stands.

Climax plant community. The plant community on a given site that will be established if present environmental conditions continue to prevail and the site is properly managed.

Closed depression. A low area completely surrounded by higher ground and having no natural outlet.

Coarse fragments. Mineral or rock particles larger than 2 millimeters in diameter.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 cm) in diameter.

Cobbly soil material. Material that is 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 cm) in diameter. Very cobbly soil material is 35 to 60 percent of these rock fragments, and extremely cobbly soil material is more than 60 percent.

Codominant trees. Trees whose crowns form the general level of the forest canopy and that receive full light from above but comparatively little from the sides.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Commercial forest. Forest land capable of producing 20 cubic feet or more per acre per year at the culmination of mean annual increment.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Congeliturbate. Soil material disturbed by frost action.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain

grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage. Any tillage and planting system in which a cover of crop residue is maintained on at least 30 percent of the soil surface after planting in order to reduce the hazard of water erosion; in areas where soil blowing is the primary concern, a system that maintains a cover of at least 1,000 pounds of flat residue of small grain or the equivalent during the critical erosion period.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:
Loose—Noncoherent when dry or moist; does not hold together in a mass.
Friable—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic—Readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky—Adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft—When dry, breaks into powder or individual grains under very slight pressure.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Culmination of the mean annual increment (CMAI). The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Deep soil. A soil that is 40 to 60 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Dense layer (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

Depth, soil. Generally, the thickness of soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 20 inches.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Dominant trees. Trees whose crowns form the general level of the forest canopy and that receive full light from above and from the sides.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Drainageway. An area of ground at a lower elevation than the surrounding ground and in which water collects and is drained to a closed depression or lake or to a drainageway at a lower elevation. A drainageway may or may not have distinctly incised channels at its upper reaches or throughout its course.

Drumlin. A low, smooth, elongated oval hill, mound, or ridge of compact glacial till. The longer axis is parallel to the path of the glacier and commonly has a blunt nose pointing in the direction from which the ice approached.

Edaphic (adj.). Pertaining to the soil and particularly the influence of soil on organisms.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Ericaceous. Refers to the heath family, Ericacease, e.g., blueberry.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic)—Erosion caused by geologic processes acting over long geologic periods, and resulting in the wearing away of mountains and the building up of such landscape features as floodplains and coastal plains. Synonym: natural erosion.

Erosion (accelerated)—Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, for example, fire, that exposes the surface.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. The term is more often applied to cliffs resulting from differential erosion.

Esker. A long, narrow, sinuous, steep-sided ridge composed of irregularly stratified sand and gravel that were deposited by a subsurface stream flowing between ice walls or through ice tunnels of a retreating glacier, and that were left behind when the ice melted. Eskers range from less than a mile to more than 100 miles in length and from 10 to 100 feet in height.

Even aged. Refers to a stand of trees in which only small differences in age occur between the individuals. A range of 20 years is allowed.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Extrusive rock. Igneous rock derived from deep-seated molten matter (magma) emplaced on the earth's surface.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants

when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

Firebreak. An area cleared of flammable material to stop or help control creeping or running fires. A firebreak also serves as a line from which to work and to facilitate the movement of fire fighters and equipment. Designated roads also serve as firebreaks.

Flaggy soil material. Material that is, by volume, 15 to 35 percent flagstones. Very flaggy soil material is 35 to 60 percent flagstones, and extremely flaggy soil material is more than 60 percent flagstones.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 cm) long.

Floodplain. A nearly level alluvial plain that borders a stream and is subject to inundation under flood-stage conditions unless protected artificially. It is usually a constructional landform built of sediment deposited during overflow and lateral migration of the stream.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Foot slope. The geomorphic component that forms the inner, gently inclined surface at the base of a hill slope. The surface profile is dominantly concave. In terms of gradational processes, a foot slope is a transition zone between an upslope site of erosion (back slope) and a downslope site of deposition (toe slope).

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Forest type. A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.

Fragile (in tables). A soil that is easily damaged by use or disturbance.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes, or soil-forming factors, responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial drift (geology). Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glacial till (geology). Unsorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Glaciolacustrine deposits. Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are interbedded or laminated.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 mm to 7.6 cm) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 cm) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Heavy metal. Inorganic substances that are solid at ordinary temperatures and are not soluble in water. They form oxides and hydroxides that are basic. Examples are copper, iron, cadmium, zinc, manganese, lead, and arsenic.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 8 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons of mineral soil are as follows:

O horizon—An organic layer of fresh and decaying plant residue.

A horizon—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

E horizon—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

C horizon—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the number 2 precedes the letter C.

Cr horizon—Sedimentary beds of consolidated sandstone and semiconsolidated and consolidated shale. Generally, roots can penetrate this horizon only along fracture planes.

R layer—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Igneous rock. Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Lake plain. A surface marking the floor of an extinct lake, filled in by well sorted, stratified sediments.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 cm) or more across. Large stones adversely affect the specified use of the soil.

Lateral moraine. A ridgelike moraine carried on and deposited at the side margin of a valley glacier. It is composed chiefly of rock fragments derived from the valley walls by glacial abrasion and plucking, or by mass wasting.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand and loamy sand.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loamy soil. Coarse sandy loam, sandy loam, fine sandy loam, very fine sandy loam, loam, silt loam, silt, clay loam, sandy clay loam, or silty clay loam.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Marl. An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal amounts.

Mean annual increment (MAI). The average annual increase in volume of a tree during the entire life of the tree.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Merchantable trees. Trees that are of sufficient size to be economically processed into wood products.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Minor components. A component of limited extent that may not be present.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately deep soil. A soil that is 20 to 40 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Moraine. An accumulation of glacial drift in a topographic landform of its own, resulting chiefly from the direct action of glacial ice. Some types are lateral, recessional, and terminal.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Mountain. A natural elevation of the land surface, rising more than 1,000 feet above surrounding lowlands, commonly of limited summit area and generally having steep sides (slopes greater than 25 percent) and considerable bare-rock surface. A mountain can occur as a single, isolated mass or in a group forming a chain or range. Mountains are primarily formed by deep-seated earth movements or volcanic action and secondarily by differential erosion.

Muck. Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Narrow-base terrace. A terrace no more than 4 to 8 feet wide at the base. A narrow-base terrace is similar to a broad-base terrace, except for the width of the ridge and channel.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil, and carbon, hydrogen, and oxygen obtained from the air and water.

Observed rooting depth. Depth to which roots have been observed to penetrate.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Outwash glacial. Stratified sand and gravel produced by glaciers and carried, sorted, and deposited by glacial melt water.

Outwash plain. An extensive area of glaciofluvial material that was deposited by meltwater streams.

Overstory. The trees in a forest that form the upper crown cover.

Oxbow. The horseshoe-shaped channel of a former meander, remaining after the stream formed a cutoff across a narrow meander neck.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square

m to 10 square m), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permafrost. Layers of soil, or even bedrock, occurring in arctic or subarctic regions, in which a temperature below freezing has existed continuously for a long time.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	Less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	More than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability or an impermeable layer near the surface, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

Potential native plant community. See Climax plant community.

Potential rooting depth (effective rooting depth). Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

Prescribed burning. The application of fire to land under such conditions of weather, soil moisture, and time of day as presumably will result in the intensity of heat and spread required to accomplish specific forest management, wildlife, grazing, or fire hazard reduction purposes.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	Below 3.5
Extremely acid	3.5 to 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regeneration. The new growth of a natural plant community, developing from seed.

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth’s surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Riverwash. Unstable areas of sandy, silty, clayey, or gravelly sediments. These areas are flooded, washed, and reworked by rivers so frequently that they support little or no vegetation.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rock outcrop. Exposures of bare bedrock other than lava flows and rock-lined pits.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sandy soil. Sand or loamy sand.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Saprolite (soil science). Unconsolidated residual material underlying the soil and grading to hard bedrock below.

Sawlogs. Logs of suitable size and quality for the production of lumber.

Scribner's log rule. A method of estimating the number of board feet that can be cut from a log of a given diameter and length.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shallow soil. A soil that is 10 to 20 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shoulder slope. The uppermost inclined surface at the top of a hillside. It is the transition zone from the back slope to the summit of a hill or mountain. The surface is dominantly convex in profile and erosional in origin.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site class. A grouping of site indexes into five to seven production capability levels. Each level can be represented by a site curve.

Site curve (50-year). A set of related curves on a graph that shows the average height of dominant or dominant and codominant trees for the range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant or dominant and codominant trees that are 50 years old or are 50 years old at breast height.

Site curve (100-year). A set of related curves on a graph that shows the average height of dominant or dominant and codominant trees for a range of ages on soils that differ in productivity. Each level is represented by a curve. The basis of the curves is the height of dominant or dominant and codominant trees that are 100 years old or are 100 years old at breast height.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant or dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75.

Skid trails. Pathways along which logs are dragged to a common site for loading onto a logging truck.

Slash. The branches, bark, treetops, reject logs, and broken or uprooted trees left on the ground after logging.

Slippage (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In

this survey the following slope classes are recognized:

Nearly level	0 to 2 percent
Gently sloping	2 to 4 percent
Moderately sloping	4 to 8 percent
Strongly sloping	8 to 15 percent
Moderately steep	15 to 25 percent
Steep	25 to 45 percent
Very steep	More than 45 percent

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Slumping (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

Small stones (in tables). Rock fragments less than 3 inches (7.6 cm) in diameter. Small stones adversely affect the specified use of the soil.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	Less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Species. A single, distinct kind of plant or animal having certain distinguishing characteristics.

Steppe. Temperate zone vegetation dominated by grasses and occurring in climates where zonal soils are too dry to support trees.

Stones. Rock fragments 10 to 24 inches (25 to 60 cm) in diameter if rounded, or 6 to 15 inches (15 to 38 cm) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stream channel. The hollow bed where a natural stream of surface water flows or may flow; the deepest or central part of the bed, formed by the main current and covered more or less continuously by water.

Stream terrace. One of a series of platforms in a stream valley, flanking, and more or less parallel to, the stream channel. It originally formed near the level of the stream and is the dissected remnants of an abandoned floodplain, streambed, or valley floor that were produced during a former stage of erosion or deposition.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are: *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Subsurface layer. Technically, the E horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Summit. A general term for the top, or highest level, of an upland feature, such as a hill or mountain. It commonly refers to a higher area that has a gentle slope and is flanked by steeper slopes.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 cm). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Talus. Rock fragments of any size or shape, commonly coarse and angular, derived from and lying at the base of a cliff or very steep rock slope. The accumulated mass of such loose, broken rock formed chiefly by falling, rolling, or sliding.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive, nearly level to gently rolling or moderately sloping area that is underlain by, or consists of, till and that has a slope of 0 to 8 percent.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill. Toe slopes are commonly gentle and linear in profile.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Trafficability. The degree to which a soil is capable of supporting vehicular traffic across a wide range in soil moisture conditions.

Understory. Any plants in a forest community that grow to a height of less than 5 feet.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley. An elongated depressional area primarily developed by stream action.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material, rather than to be the result of poor drainage.

Varve. A sedimentary layer or a lamina, or sequence of laminae, deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

Very deep soil. A soil that is more than 60 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Very shallow soil. A soil that is less than 10 inches deep over bedrock or to other material that restricts the penetration of plant roots.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth’s surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Windthrow. The action of uprooting and tipping over trees by the wind.

Xerophyte. A plant capable of surviving periods of prolonged moisture deficiency. A plant that grows on dry sites.

Tables

TABLE 1—TEMPERATURE AND PRECIPITATION

(Recorded in the period 1966-90 at Glennallen, Alaska)

Month	Temperature						Precipitation			
				2 years in 10 will have		avg no. of grow'n degree days*		2 yrs in 10 will have		average number of days with 0.10 inch or more
	avg daily max	avg daily min	avg	max temp. >than	min temp. <than		avg (in.)	less than (in.)	more than (in.)	
January	3.1	-19.7	-8.3	44	-58	0	0.47	0.16	0.73	1
February	16.1	-10.4	2.8	45	-48	0	0.53	0.13	0.84	1
March	30.1	-1.1	14.5	50	-37	0	0.23	0.10	0.40	0
April	43.7	17.2	30.5	67	-11	0	0.14	0.07	0.27	0
May	57.1	29.1	43.1	74	14	0	0.65	0.26	1.09	1
June	66.8	38.8	52.8	83	25	50	1.36	0.79	1.99	4
July	69.9	42.6	56.2	85	27	493	1.87	1.02	2.63	5
August	67.0	37.8	52.4	84	20	25	1.51	0.71	2.20	4
September	55.2	29.0	42.1	70	5	0	1.05	0.52	1.70	3
October	36.9	16.4	26.7	56	-19	0	1.02	0.31	1.68	3
November	15.6	-5.0	5.3	43	-40	0	0.74	0.29	1.12	2
December	6.3	-14.1	-3.9	50	-50	0	1.31	0.28	2.12	3
Yearly :										
Average	39.0	13.4	26.2	----	----	----	---	---	---	---
Extreme	90	-61	---	89	-57	----	---	---	---	---
Total	---	---	---	----	----	568	10.89	5.16	12.79	27

*A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (threshold: 40.0 °F) based on the 32 degree frost-free period.

TABLE 2—TEMPERATURE AND PRECIPITATION

(Recorded in the period 1970-90 at Old Edgerton, Alaska)

Month	Temperature						Precipitation			
	avg daily max	avg daily min	avg	2 years in 10 will have: max temp. >than	2 years in 10 will have: min temp. <than	avg no. of grow'n degree days*	avg (in.)	2 yrs in 10 will have: less than (in.)	2 yrs in 10 will have: more than (in.)	average number of days with 0.10 inch or more
January	5.3	-13.8	-4.3	44	-55	0	0.57	0.19	0.88	1
February	15.7	-7.3	4.2	45	-45	0	0.54	0.20	0.83	1
March	30.5	4.7	17.6	60	-33	0	0.28	0.06	0.52	0
April	44.2	20.5	32.3	62	-9	0	0.14	0.03	0.22	0
May	57.2	31.4	44.3	73	9	0	0.56	0.18	0.87	1
June	65.9	40.0	52.9	83	16	130	1.55	1.09	1.98	4
July	69.3	44.2	56.7	85	20	520	2.10	1.43	2.72	6
August	66.3	40.9	53.6	82	14	282	1.44	0.80	2.01	4
September	54.9	32.0	43.5	71	3	0	1.13	0.51	1.65	3
October	37.4	20.6	29.0	56	-17	0	1.07	0.58	1.50	3
November	16.6	-1.2	7.7	44	-38	0	0.75	0.45	1.02	2
December	8.6	-9.4	-0.4	42	-49	0	0.84	0.32	1.27	2
Yearly :										
Average	39.3	16.9	28.1	----	----	----	---	---	---	---
Extreme	92	-58	---	88	-56	----	---	---	---	---
Total	---	---	---	----	----	932	10.97	5.76	12.90	27

*A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (threshold: 40.0 °F) based on the 32 degree frost-free season.

TABLE 3—FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1966-90 at Glennallen, Alaska)

Probability	Temperature		
	24F or lower	28F or lower	32F or lower
Last freezing temperature in spring: January-June			
1 year in 10 later than----	June 2	June 27	June 28
2 years in 10 later than---	May 29	June 23	June 26
5 years in 10 later than---	May 22	June 17	June 21
First freezing temperature in fall: August-Dec.			
1 yr in 10 earlier than----	August 16	August 7	July 29
2 yrs in 10 earlier than---	August 20	August 11	August 2
5 yrs in 10 earlier than---	August 28	August 17	August 9

TABLE 4—FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1970-90 at Old Edgerton, Alaska)

Probability	Temperature		
	24F or lower	28F or lower	32F or lower
Last freezing temperature in spring: January-June			
1 year in 10 later than----	June 3	June 19	June 24
2 years in 10 later than---	May 26	June 13	June 20
5 years in 10 later than---	May 12	June 1	June 13
First freezing temperature in fall: August-Dec.			
1 yr in 10 earlier than----	August 22	August 16	August 6
2 yrs in 10 earlier than---	August 26	August 19	August 10
5 yrs in 10 earlier than---	September 4	August 24	August 18

TABLE 5—ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
401	Badlands--	364	0.1
402	Chistochina silt loam, 0 to 7 percent slopes------------------------	840	0.1
403	Copper River peat, 0 to 2 percent slopes----------------------------	22,246	3.7
404	Copper River peat, 2 to 7 percent slopes----------------------------	35,039	5.8
405	Copper River peat, 7 to 12 percent slopes---------------------------	8,124	1.3
406	Copper River peat, 12 to 20 percent slopes--------------------------	4,653	0.8
407	Kenny Lake silt loam, 0 to 2 percent slopes-------------------------	14,597	2.4
408	Kenny Lake silt loam, 2 to 7 percent slopes-------------------------	7,552	1.2
409	Kenny Lake silt loam, 7 to 12 percent slopes------------------------	630	0.1
410	Kenny Lake silt loam, 12 to 20 percent slopes-----------------------	299	*
411	Chitina silt loam, 0 to 2 percent slopes----------------------------	809	0.1
412	Chitina silt loam, 2 to 7 percent slopes----------------------------	6,230	1.0
413	Chitina silt loam, 7 to 12 percent slopes---------------------------	1,047	0.2
414	Chitina silt loam, 12 to 20 percent slopes--------------------------	530	0.1
415	Tonsina silt loam, 0 to 2 percent slopes----------------------------	1,860	0.3
416	Tonsina silt loam, 2 to 7 percent slopes----------------------------	23,755	3.9
417	Tonsina silt loam, 7 to 12 percent slopes---------------------------	4,676	0.8
418	Tonsina silt loam, 12 to 20 percent slopes--------------------------	954	0.2
419	Copper River-Hanagita complex, 2 to 20 percent slopes---------------	518	0.1
420	Tonsina-Hanagita complex, 2 to 20 percent slopes--------------------	2,442	0.4
421	Cryochrepts-Rock outcrop complex, 30 to 70 percent slopes-----------	4,909	0.8
422	Cryofibrists-Cryohemists complex, 0 to 2 percent slopes-------------	1,724	0.3
423	Cryohemists, 0 to 2 percent slopes----------------------------------	19,819	3.3
424	Cryorthents and Cryochrepts, 30 to 70 percent slopes----------------	39,750	6.5
425	Dadina peat, 0 to 2 percent slopes----------------------------------	2,481	0.4
426	Dadina-Klanelneechena complex, 0 to 2 percent slopes----------------	1,259	0.2
427	Dadina-Tolsona complex, 0 to 5 percent slopes-----------------------	1,481	0.2
428	Pits, gravel--	836	0.1
429	Gulkana silt loam, 0 to 2 percent slopes----------------------------	11,208	1.8
430	Gulkana silt loam, 2 to 7 percent slopes----------------------------	6,189	1.0
431	Gulkana silt loam, 7 to 12 percent slopes---------------------------	420	0.1
432	Gulkana silt loam, 12 to 20 percent slopes--------------------------	277	*
433	Klawasi peat, 0 to 2 percent slopes---------------------------------	7,101	1.2
434	Klawasi peat, 2 to 7 percent slopes---------------------------------	1,797	0.3
435	Klawasi peat, 7 to 12 percent slopes--------------------------------	168	*
436	Klawasi peat, cool, 0 to 7 percent slopes---------------------------	56,796	9.3
437	Klawasi peat, cool, 7 to 20 percent slopes--------------------------	481	0.1
438	Klawasi peat, depressional, 0 to 2 percent slopes-------------------	11,280	1.9
439	Gakona silt loam, cool, 0 to 7 percent slopes-----------------------	25,075	4.1
440	Gakona silt loam, cool, 7 to 20 percent slopes----------------------	1,093	0.2
441	Gakona silt loam, 0 to 2 percent slopes-----------------------------	14,228	2.3
442	Gakona silt loam, 2 to 7 percent slopes-----------------------------	984	0.2
443	Gakona silt loam, 7 to 12 percent slopes----------------------------	463	0.1
444	Gakona silt loam, 12 to 20 percent slopes---------------------------	278	*
445	Klawasi-Tolsona complex, 0 to 2 percent slopes----------------------	4,202	0.7
446	Gakona-Stuck complex, 0 to 2 percent slopes-------------------------	4,501	0.7
447	Gakona-Chetaslina complex, 0 to 2 percent slopes--------------------	1,695	0.3
448	Klawasi-Wrangell complex, 0 to 2 percent slopes---------------------	19,257	3.2
449	Klutina-Klutina, rarely flooded, complex, 0 to 2 percent slopes----	8,586	1.4
450	Klutina silt loam, rarely flooded, 2 to 7 percent slopes------------	1,089	0.2
451	Klutina-Nizina complex, 0 to 2 percent slopes-----------------------	7,163	1.2
452	Kuslina peat, 0 to 2 percent slopes---------------------------------	9,777	1.6
453	Kuslina peat, 2 to 7 percent slopes---------------------------------	1,914	0.3
454	Mendeltna peat, 0 to 7 percent slopes-------------------------------	46,047	7.6
455	Chetaslina silt loam, 0 to 7 percent slopes-------------------------	8,357	1.4
456	Chetaslina silt loam, thin surface, 0 to 7 percent slopes-----------	6,343	1.0
457	Mendeltna-Tebay complex, 0 to 10 percent slopes---------------------	4,149	0.7
458	Nizina-Nizina, rarely flooded, complex, 0 to 5 percent slopes------	5,469	0.9
459	Pippin silt loam, 0 to 12 percent slopes----------------------------	12,430	2.0
460	Pippin silt loam, 12 to 45 percent slopes---------------------------	279	*

*See footnote at end of table.

TABLE 5—ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS—Continued

Map symbol	Soil name	Acres	Percent
461	Riverwash-Nizina complex, 0 to 2 percent slopes--------------------	8,185	1.3
462	Taral mucky silt loam, 20 to 45 percent slopes---------------------	810	0.1
463	Taral-Hanagita complex, 12 to 35 percent slopes--------------------	1,515	0.2
464	Strelna-Hanagita-Copper River complex, 15 to 55 percent slopes-----	13,880	2.3
465	Tebay silt loam, 0 to 7 percent slopes-----------------------------	2,659	0.4
466	Tebay silt loam, 7 to 20 percent slopes----------------------------	5,040	0.8
467	Tebay silt loam, thin surface, 0 to 7 percent slopes---------------	2,605	0.4
468	Tebay silt loam, thin surface, 7 to 20 percent slopes--------------	734	0.1
469	Tolsona peat, 0 to 7 percent slopes--------------------------------	48,478	8.0
470	Tolsona peat, 7 to 12 percent slopes-------------------------------	3,714	0.6
471	Tsana silt loam, 0 to 7 percent slopes-----------------------------	6,750	1.1
472	Tsana silt loam, thin surface, 0 to 7 percent slopes---------------	9,569	1.6
473	Tsana silt loam, thin surface, 7 to 20 percent slopes--------------	599	0.1
474	Tolsona-Klanelneechena complex, 0 to 7 percent slopes--------------	3,995	0.7
475	Wrangell peat, 0 to 2 percent slopes-------------------------------	7,271	1.2
W	Water--	4,297	0.7
		--------	-------
	Total--	608,522	100.0

* Less than 0.1 percent.

TABLE 6—WHITE SPRUCE PRODUCTIVITY.

(Only soils suitable for commercial production of white spruce are listed. Dashed entries indicate that data were not available.)

Map Symbol and Soil Name	Mean Site Index (Farr 1967)	Range in Site Index	Sample Size		Estimated Cubic-foot Volume at age 100 Years (Farr 1967)		Productivity Class
			No. of Plots	No. of Trees	Trees >4.5 Inches DBH	Trees >8.5 Inches DBH	
403, 404, 405, 406- Copper River	---	---	--	--	----	----	-
407, 408, 409------ Kenny Lake	77	66-89	6	30	3050	1500	2
410---------------- Kenny Lake	77	66-89	6	30	3050	1500	2
411, 412, 413------ Chitina	64	56-72	5	27	2050	550	1
414---------------- Chitina	64	56-72	5	27	2050	550	1
415, 416, 417------ Tonsina	64	58-71	6	30	2050	550	1
418---------------- Tonsina	64	58-71	6	30	2050	550	1
419*:							
Copper River------	64**	---	--	--	2050	550	1
Hanagita----------	---	---	--	--	----	----	-
420*:							
Tonsina-----------	64**	---	--	--	2050	550	1
Hanagita----------	---	---	--	--	----	----	-
429, 430, 431------ Gulkana	74	51-92	14	70	2800	1300	2
432---------------- Gulkana	74	51-92	14	70	2800	1300	2
433, 434, 435------ Klawasi	72**	---	--	--	2600	1100	2
436, 437----------- Klawasi	---	---	--	--	----	----	-
439, 440----------- Gakona	---	---	--	--	----	----	-
441, 442, 443------ Gakona	72	61-87	5	26	2600	1100	2
444---------------- Gakona	---	---	--	--	----	----	-
445*:							
Klawasi-----------	72**	---	--	--	2600	1100	2

*See footnote at end of table.

TABLE 6—WHITE SPRUCE PRODUCTIVITY—Continued

Map Symbol and Soil Name	Mean Site Index (Farr 1967)	Range in Site Index	Sample Size		Estimated Cubic-foot Volume at age 100 Years (Farr 1967)		Productivity Class
			No. of Plots	No. of Trees	Trees >4.5 Inches DBH	Trees >8.5 Inches DBH	
445*: cont'd Tolsona-----------	65**	---	--	--	2100	600	1
446*: Gakona------------	72	61-87	5	26	2600	1100	2
Stuck-------------	---	---	--	--	----	----	-
447*: Gakona------------	72	61-87	5	26	2600	1100	2
Chetaslina--------	69***	---	--	--	2390	900	2
449*: Klutina.							
Klutina-----------	70	60-80	7	37	2450	950	2
450---------------- Klutina	70	60-80	7	37	2450	950	2
451*: Klutina.	---	---	--	--	----	----	-
Nizina.	---	---	--	--	----	----	-
Klutina-----------	70	60-80	7	37	2450	950	2
454---------------- Mendeltna	69**	---	--	--	2390	900	2
455, 456----------- Chetaslina	69***	---	--	--	2390	900	2
457*: Mendeltna---------	69**	---	--	--	2390	900	2
Tebay-------------	---	---	--	--	----	----	-
458*: Nizina.	---	---	--	--	----	----	-
Nizina------------	69	58-76	5	25	2400	900	2
459---------------- Pippin	69	56-87	5	26	2400	900	2
462---------------- Taral	---	---	--	--	----	----	-
463*: Taral-------------	---	---	--	--	----	----	-
Hanagita----------	---	---	--	--	----	----	-
464*: Strelna-----------	---	---	--	--	----	----	-

*See footnote at end of table.

TABLE 6—WHITE SPRUCE PRODUCTIVITY—Continued

Map Symbol and Soil Name	Mean Site Index (Farr 1967)	Range in Site Index	Sample Size		Estimated Cubic-foot Volume at age 100 Years (Farr 1967)		Productivity Class
			No. of Plots	No. of Trees	Trees >4.5 Inches DBH	Trees >8.5 Inches DBH	
464*: cont'd							
Hanagita----------	---	---	--	--	----	----	-
Copper River------	---	---	--	--	----	----	-
465, 466----------- Tebay	---	---	--	--	----	----	-
467, 468----------- Tebay	---	---	--	--	----	----	-
469, 470----------- Tolsona	65**	---	--	--	2100	600	1
471, 472,---------- Tsana	65	51-84	5	25	2100	600	1
473---------------- Tsana	65	---	5	25	2100	600	-
474*:							
Tolsona-----------	65**	---	--	--	2100	600	1
Klanelneechena----	--	---	--	--	----	----	

* See description of the map unit for composition and behavior characteristics of the map unit.
** Estimated for soil in thawed condition.
*** Estimated.

TABLE 7—FORESTLAND MANAGEMENT

(Only the soils suitable for production of commercial trees are listed. A dashed entry indicates that information was not available.)

Map symbol and soil name	Ordination symbol	Management concerns					Common trees
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	
403, 404, 405, 406- Copper River	--	--	--	--	--	--	Black spruce
407, 408, 409------ Kenny Lake	2A	Slight	Moderate	Slight	Moderate	Moderate	White spruce Quaking aspen
410---------------- Kenny Lake	2R	Moderate	Moderate	Slight	Moderate	Moderate	White spruce Quaking aspen
411, 412, 413------ Chitina	1A	Slight	Moderate	Slight	Moderate	Moderate	White spruce Quaking aspen
414---------------- Chitina	1R	Moderate	Moderate	Slight	Moderate	Moderate	White spruce Quaking aspen
415, 416, 417------ Tonsina	1A	Slight	Moderate	Slight	Moderate	Moderate	White spruce Quaking aspen
418---------------- Tonsina	1R	Moderate	Moderate	Slight	Moderate	Moderate	White spruce Quaking aspen
419*:							
Copper River**---- thawed	1A	Moderate	Moderate	Slight	Moderate	Moderate	White spruce Paper Birch
Copper River***--- frozen,permafrost	--	Severe	Severe	Severe	Severe	Severe	White spruce Black spruce
Hanagita----------	--	Moderate	Moderate	Slight	Moderate	Moderate	White spruce Paper birch
420*:							
Tonsina-----------	1A	Slight	Moderate	Slight	Moderate	Moderate	White spruce Paper birch
Hanagita----------	--	Moderate	Moderate	Slight	Moderate	Moderate	White spruce Paper birch
429, 430, 431------ Gulkana	2A	Slight	Moderate	Moderate	Moderate	Moderate	White spruce Quaking aspen Balsam poplar
432---------------- Gulkana	2R	Moderate	Moderate	Moderate	Moderate	Moderate	White spruce Quaking aspen
433, 434, 435:							
Klawasi**--------- thawed	2C	Slight	Moderate	Moderate	Moderate	Moderate	White spruce Quaking aspen
Klawasi***-------- frozen,permafrost	--	Severe	Severe	Severe	Severe	Severe	White spruce Black spruce

*See footnote at end of table.

TABLE 7—FORESTLAND MANAGEMENT—Continued

Map symbol and soil name	Ordination symbol	Management concerns					Common trees
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	
436, 437:							
Klawasi**--------- thawed	--	Slight	Moderate	Moderate	Moderate	Moderate	Black spruce White spruce
Klawasi***-------- frozen,permafrost	--	Severe	Severe	Severe	Severe	Severe	White spruce Black spruce
439, 440----------- Gakona	2C	Slight	Moderate	Moderate	Moderate	Moderate	White spruce Quaking aspen
441, 442, 443------ Gakona	2C	Slight	Moderate	Moderate	Moderate	Moderate	White spruce Quaking aspen
444---------------- Gakona	2R	Moderate	Moderate	Moderate	Moderate	Moderate	White spruce Quaking aspen
445*:							
Klawasi**--------- thawed	2C	Slight	Moderate	Moderate	Moderate	Moderate	White spruce Quaking aspen
Klawasi***-------- frozen,permafrost	--	Severe	Severe	Severe	Severe	Severe	White spruce Black spruce
Tolsona**--------- thawed	1A	Slight	Slight	Slight	Moderate	Slight	White spruce Quaking aspen
Tolsona***-------- frozen,permafrost	--	Severe	Severe	Severe	Severe	Severe	White spruce Black spruce
446*:							
Gakona------------	2C	Slight	Moderate	Moderate	Moderate	Moderate	White spruce Quaking aspen
Stuck-------------	--	Slight	Moderate	Moderate	Moderate	Slight	White spruce
447*:							
Gakona------------	2C	Slight	Moderate	Moderate	Moderate	Moderate	White spruce Quaking aspen
Chetaslina--------	2A	Slight	Moderate	Slight	Moderate	Moderate	White spruce Quaking aspen
449*:							
Klutina.	--	--	--	--	--	--	--
Klutina-----------	2A	Slight	Slight	Slight	Moderate	Slight	White spruce Balsam poplar
450---------------- Klutina	2A	Slight	Slight	Slight	Moderate	Slight	White spruce Balsam poplar
451*:							
Klutina.	--	--	--	--	--	--	--
Nizina.	--	--	--	--	--	--	--

*See footnote at end of table.

TABLE 7—FORESTLAND MANAGEMENT—Continued

Map symbol and soil name	Ordi- nation symbol	Management concerns: Erosion hazard	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Plant competi- tion	Common trees
451*: cont'd							
Klutina-----------	2A	Slight	Slight	Slight	Moderate	Slight	White spruce Balsam poplar
454:							
Mendeltna**------- thawed	2A	Slight	Moderate	Slight	Moderate	Moderate	White spruce Quaking aspen
Mendeltna***------ frozen,permafrost	--	Severe	Severe	Severe	Severe	Severe	White spruce Black spruce
455, 456----------- Chetaslina	2A	Slight	Moderate	Slight	Moderate	Moderate	White spruce Quaking aspen
457*:							
Mendeltna**------- thawed	2A	Slight	Moderate	Slight	Moderate	Moderate	White spruce Quaking aspen
Mendeltna***------ frozen,permafrost	--	Severe	Severe	Severe	Severe	Severe	White spruce Black spruce
Tebay-------------	--	Slight	Slight	Slight	Moderate	Slight	Quaking aspen
458*:							
Nizina.	--	--	--	--	--	--	--
Nizina------------	2F	Slight	Moderate	Severe	Severe	Moderate	White spruce Balsam poplar
459---------------- Pippin	2F	Slight	Moderate	Severe	Severe	Slight	Quaking aspen White spruce
462---------------- Taral	--	Severe	Severe	Slight	Moderate	Moderate	White spruce Paper birch
463*:							
Taral-------------	--	Severe	Severe	Slight	Moderate	Moderate	White spruce Paper birch
Hanagita----------	--	Severe	Severe	Slight	Moderate	Moderate	White spruce Paper birch
464*:							
Strelna**--------- thawed	--	Severe	Severe	Slight	Moderate	Moderate	White spruce Paper birch
Strelna***-------- frozen,permafrost	--	Severe	Severe	Severe	Severe	Severe	White spruce Paper birch
Hanagita----------	--	Severe	Severe	Slight	Moderate	Moderate	White spruce Paper birch
Copper River**---- thawed	--	Moderate	Moderate	Slight	Moderate	Moderate	White spruce Paper Birch
Copper River***--- frozen,permafrost	--	Severe	Severe	Severe	Severe	Severe	White spruce Black spruce

*See footnote at end of table.

TABLE 7—FORESTLAND MANAGEMENT—Continued

Map symbol and soil name	Ordi-nation symbol	Management concerns					Common trees
		Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Plant competi-tion	
465, 466----------- Tebay		Slight	Slight	Slight	Moderate	Slight	Quaking aspen
467, 468----------- Tebay		Slight	Slight	Slight	Moderate	Slight	Quaking aspen
469, 470:							
Tolsona**--------- thawed	1A	Slight	Slight	Slight	Moderate	Slight	White spruce Quaking aspen
Tolsona***-------- frozen,permafrost	--	Severe	Severe	Severe	Severe	Severe	White spruce Black spruce
471, 472, --------- Tsana	1A	Slight	Slight	Slight	Moderate	Slight	White spruce Quaking aspen
473---------------- Tsana	1R	Slight	Slight	Slight	Moderate	Slight	White spruce Quaking aspen
474*:							
Tolsona**---------	1A	Slight	Slight	Slight	Moderate	Slight	White spruce Quaking aspen
Tolsona***-------- frozen,permafrost	--	Severe	Severe	Severe	Severe	Severe	White spruce Black spruce
Klanelneechena.							Black spruce

* See description of the map unit for composition and behavior characteristics of the map unit.
** Soil has permafrost; interpretations are estimated based on soil under thawed condition.
*** Soil has permafrost; interpretations are estimated based on perennial frost.

TABLE 8—BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the glossary [page 197]. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
401*. Badlands.					
402--------------- Chistochina	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight.
403, 404---------- Copper River	Severe: permafrost, wetness.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.
405--------------- Copper River	Severe: permafrost, wetness, slippage.	Severe: permafrost, wetness, slippage.	Severe: permafrost, wetness, slippage.	Severe: permafrost, wetness, slope.	Severe: permafrost, wetness, slippage.
406--------------- Copper River	Severe: permafrost, wetness, slope.	Severe: permafrost, wetness, slope.	Severe: permafrost, wetness, slope.	Severe: permafrost, wetness, slope.	Severe: permafrost, wetness, slope.
407--------------- Kenny Lake	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.
408--------------- Kenny Lake	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.
409--------------- Kenny Lake	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.
410--------------- Kenny Lake	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope, frost action.
411--------------- Chitina	Moderate: cutbanks cave, too clayey.	Slight---------	Slight---------	Slight---------	Severe: frost action.
412--------------- Chitina	Moderate: cutbanks cave, too clayey.	Slight---------	Slight---------	Moderate: slope.	Severe: frost action.
413--------------- Chitina	Moderate: cutbanks cave, too clayey, slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.

*See footnote at end of table.

TABLE 8—BUILDING SITE DEVELOPMENT—Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
414--------------- Chitina	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.
415--------------- Tonsina	Slight---------	Slight---------	Slight---------	Slight---------	Severe: frost action.
416--------------- Tonsina	Slight---------	Slight---------	Slight---------	Moderate: slope.	Severe: frost action.
417--------------- Tonsina	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.
418--------------- Tonsina	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.
419*:					
Copper River-----	Severe: permafrost, wetness, slippage.	Severe: permafrost, wetness, slippage.	Severe: permafrost, wetness, slippage.	Severe: permafrost, wetness, slope.	Severe: permafrost, wetness, slippage.
Hanagita---------	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope, frost action.
420*:					
Tonsina----------	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.
Hanagita---------	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope, frost action.
421*:					
Cryochrepts.					
Rock outcrop.					
422*:					
Cryofibrists.					
Cryohemists.					
423. Cryohemists					
424*:					
Cryorthents.					
Cryochrepts.					
425--------------- Dadina	Severe: permafrost, cutbanks cave, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost.

*See footnote at end of table.

TABLE 8—BUILDING SITE DEVELOPMENT—Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
426*:					
Dadina-----------	Severe: permafrost, cutbanks cave, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost.
Klanelneechena---	Severe: permafrost, cutbanks cave, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, frost action.
427*:					
Dadina-----------	Severe: permafrost, cutbanks cave, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost.
Tolsona----------	Severe: permafrost, wetness.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, frost action, thermokarst.
428*. Pits.					
429*-------------- Gulkana	Severe: cutbanks cave.	Moderate: large stones.	Moderate: large stones.	Moderate: large stones.	Severe: frost action.
430--------------- Gulkana	Severe: cutbanks cave.	Moderate: large stones.	Moderate: large stones.	Moderate: slope, large stones.	Severe: frost action.
431--------------- Gulkana	Severe: cutbanks cave.	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: slope.	Severe: frost action.
432--------------- Gulkana	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.
433, 434---------- Klawasi	Severe: permafrost, wetness.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, low strength, thermokarst.
435--------------- Klawasi	Severe: permafrost, wetness, slippage.	Severe: permafrost, wetness, slippage.	Severe: permafrost, wetness, slippage.	Severe: permafrost, wetness, slope.	Severe: permafrost, low strength, slippage.
436--------------- Klawasi	Severe: permafrost, wetness.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, low strength, thermokarst.
437--------------- Klawasi	Severe: permafrost, wetness, slippage.	Severe: permafrost, wetness, slippage.	Severe: permafrost, wetness, slippage.	Severe: permafrost, wetness, slope.	Severe: permafrost, low strength, slippage.

*See footnote at end of table.

TABLE 8—BUILDING SITE DEVELOPMENT—Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
438--------------- Klawasi	Severe: permafrost, wetness.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, low strength, wetness.
439--------------- Gakona	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
440--------------- Gakona	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.
441--------------- Gakona	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
442--------------- Gakona	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
443--------------- Gakona	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.
444--------------- Gakona	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.
445*:					
Klawasi----------	Severe: permafrost, wetness.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, low strength, thermokarst.
Tolsona----------	Severe: permafrost, wetness.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, frost action, thermokarst.
446*:					
Gakona-----------	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Stuck------------	Severe: cutbanks cave.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
447*:					
Gakona-----------	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Chetaslina-------	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength, frost action.

*See footnote at end of table.

TABLE 8—BUILDING SITE DEVELOPMENT—Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
448*:					
Klawasi----------	Severe: permafrost, wetness.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, low strength, thermokarst.
Wrangell---------	Severe: permafrost, excess humus, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, low strength, wetness.
Klawasi----------	Severe: permafrost, wetness.	Severe: permafrost, wetness. thermokarst.	Severe: permafrost, wetness. thermokarst.	Severe: permafrost, wetness. thermokarst.	Severe: permafrost, low strength, wetness.
449*:					
Klutina----------	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Klutina----------	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, large stones.
450--------------- Klutina	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, large stones.
451*:					
Klutina----------	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Nizina-----------	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Klutina----------	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, large stones.
452, 453---------- Kuslina	Severe: permafrost, cutbanks cave, wetness.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, frost action, thermokarst.
454--------------- Mendeltna	Severe: permafrost, wetness.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, frost action, thermokarst.
455, 456---------- Chetaslina	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength, frost action.
457*:					
Mendeltna--------	Severe: permafrost, wetness.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, frost action, thermokarst.

*See footnote at end of table.

TABLE 8—BUILDING SITE DEVELOPMENT—Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
457*: cont'd					
Tebay------------	Slight---------	Slight---------	Slight---------	Moderate: slope.	Moderate: frost action.
458*:					
Nizina-----------	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Nizina-----------	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, large stones.
459--------------- Pippin	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight.
460--------------- Pippin	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
461*:					
Riverwash.					
Nizina-----------	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
462--------------- Taral	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.
463*:					
Taral------------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.
Hanagita---------	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope, frost action.
464*:					
Strelna----------	Severe: permafrost, excess humus, slope.	Severe: permafrost, low strength, slope.	Severe: permafrost, slippage, slope.	Severe: permafrost, slope, low strength.	Severe: permafrost, slope, frost action.
Hanagita---------	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope, frost action.
Copper River-----	Severe: permafrost, wetness, slope.	Severe: permafrost, wetness, slope.	Severe: permafrost, wetness, slope.	Severe: permafrost, wetness, slope.	Severe: permafrost, wetness, slope.
465--------------- Tebay	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: frost action.

*See footnote at end of table.

TABLE 8—BUILDING SITE DEVELOPMENT—Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
466--------------- Tebay	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.
467--------------- Tebay	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: frost action.
468--------------- Tebay	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.
469--------------- Tolsona	Severe: permafrost, wetness.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, frost action, thermokarst.
470--------------- Tolsona	Severe: permafrost, wetness, slippage.	Severe: permafrost, wetness, slippage.	Severe: permafrost, wetness, slippage.	Severe: permafrost, wetness, slope.	Severe: permafrost, frost action, slippage.
471, 472---------- Tsana	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: frost action.
473--------------- Tsana	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, frost action.
474*:					
Tolsona----------	Severe: permafrost, wetness.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, frost action, thermokarst.
Klanelneechena---	Severe: permafrost, cutbanks cave, wetness.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, frost action, thermokarst.
475--------------- Wrangell	Severe: permafrost, excess humus, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, low strength, wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9—SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the glossary [page 197]. See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
401*. Badlands.					
402------------- Chistochina	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
403, 404-------- Copper River	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, slippage.	Severe: permafrost, wetness.	Severe: permafrost, wetness, thermokarst.	Poor: permafrost, wetness.
405------------- Copper River	Severe: permafrost, wetness, slippage.	Severe: permafrost, slope, excess humus.	Severe: permafrost, wetness, slippage.	Severe: permafrost, wetness, slippage.	Poor: permafrost, wetness.
406------------- Copper River	Severe: permafrost, wetness, slope.	Severe: permafrost, slope, excess humus.	Severe: permafrost, wetness, slope.	Severe: permafrost, wetness, slope.	Poor: permafrost, slope, wetness.
407------------- Kenny Lake	Moderate: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight---------	Poor: too clayey, hard to pack.
408------------- Kenny Lake	Moderate: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight---------	Poor: too clayey, hard to pack.
409------------- Kenny Lake	Moderate: percs slowly, slope.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
410------------- Kenny Lake	Severe: slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
411------------- Chitina	Moderate: percs slowly.	Moderate: seepage.	Slight---------	Slight---------	Fair: thin layer.
412------------- Chitina	Moderate: percs slowly.	Moderate: seepage, slope.	Slight---------	Slight---------	Fair: thin layer.
413------------- Chitina	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope, thin layer.
414------------- Chitina	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

*See footnote at end of table.

TABLE 9—SANITARY FACILITIES—Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
415------------- Tonsina	Moderate: percs slowly.	Moderate: seepage.	Slight---------	Slight---------	Fair: small stones.
416------------- Tonsina	Moderate: percs slowly.	Moderate: seepage, slope.	Slight---------	Slight---------	Fair: small stones.
417------------- Tonsina	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: small stones, slope.
418------------- Tonsina	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
419*:					
Copper River---	Severe: permafrost, wetness, slippage.	Severe: permafrost, slope, excess humus.	Severe: permafrost, wetness, slippage.	Severe: permafrost, wetness, slippage.	Poor: permafrost, wetness.
Hanagita-------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
420*:					
Tonsina--------	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: small stones, slope.
Hanagita-------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
421*: Cryochrepts.					
Rock outcrop.					
422*: Cryofibrists.					
Cryohemists.					
423. Cryohemists.					
424*: Cryorthents.					
Cryochrepts.					
425------------- Dadina	Severe: permafrost, wetness, poor filter.	Severe: permafrost, seepage, excess humus.	Severe: permafrost, seepage, wetness.	Severe: permafrost, seepage, wetness.	Poor: permafrost, seepage, too sandy.

*See footnote at end of table.

TABLE 9—SANITARY FACILITIES—Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
426*:					
Dadina---------	Severe: permafrost, wetness, poor filter.	Severe: permafrost, seepage, excess humus.	Severe: permafrost, seepage, wetness.	Severe: permafrost, seepage, wetness.	Poor: permafrost, seepage, too sandy.
Klanelneechena-	Severe: permafrost, wetness, poor filter.	Severe: permafrost, seepage, excess humus.	Severe: permafrost, seepage, wetness.	Severe: permafrost, seepage, wetness.	Poor: permafrost, too sandy, wetness.
427*:					
Dadina---------	Severe: permafrost, wetness, poor filter.	Severe: permafrost, seepage, excess humus.	Severe: permafrost, seepage, wetness.	Severe: permafrost, seepage, wetness.	Poor: permafrost, seepage, too sandy.
Tolsona--------	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, excess humus, thermokarst.	Severe: permafrost, wetness.	Severe: permafrost, wetness, thermokarst.	Poor: permafrost, wetness.
428*. Pits.					
429*, 430------- Gulkana	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
431------------- Gulkana	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
432------------- Gulkana	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
433, 434-------- Klawasi	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, excess humus, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Poor: permafrost, too clayey.
435------------- Klawasi	Severe: permafrost, wetness, slippage.	Severe: permafrost, slope, excess humus.	Severe: permafrost, wetness, slippage.	Severe: permafrost, wetness, slippage.	Poor: permafrost, too clayey.
436------------- Klawasi	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, excess humus, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Poor: permafrost, too clayey.
437------------- Klawasi	Severe: permafrost, wetness, slippage.	Severe: permafrost, slope, excess humus.	Severe: permafrost, wetness, slippage.	Severe: permafrost, wetness, slippage.	Poor: permafrost, too clayey.

*See footnote at end of table.

TABLE 9—SANITARY FACILITIES—Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
438------------- Klawasi	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, excess humus, wetness.	Severe: permafrost, wetness, too clayey.	Severe: permafrost, wetness, thermokarst.	Poor: permafrost, too clayey, wetness.
439------------- Gakona	Moderate: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight---------	Poor: too clayey.
440------------- Gakona	Moderate: percs slowly, slope.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
441------------- Gakona	Moderate: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight---------	Poor: too clayey.
442------------- Gakona	Moderate: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight---------	Poor: too clayey.
443------------- Gakona	Moderate: percs slowly, slope.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
444------------- Gakona	Severe: slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, slope.
445*:					
Klawasi--------	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, excess humus, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Poor: permafrost, too clayey.
Tolsona--------	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, excess humus, thermokarst.	Severe: permafrost, wetness.	Severe: permafrost, wetness, thermokarst.	Poor: permafrost, wetness.
446*:					
Gakona---------	Moderate: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight---------	Poor: too clayey.
Stuck----------	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: wetness, too clayey.	Severe: seepage, wetness.	Poor: too clayey, hard to pack.
447*:					
Gakona---------	Moderate: percs slowly.	Moderate: seepage.	Severe: too clayey.	Slight---------	Poor: too clayey.
Chetaslina-----	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey, large stones.	Slight---------	Poor: small stones.

*See footnote at end of table.

TABLE 9—SANITARY FACILITIES—Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
448*:					
Klawasi--------	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, excess humus, thermokarst.	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, wetness, thermokarst.	Poor: permafrost, too clayey.
Wrangell-------	Severe: permafrost, wetness, percs slowly.	Severe: permafrost, seepage, excess humus.	Severe: permafrost, wetness, too clayey.	Severe: permafrost, seepage, wetness.	Poor: permafrost, too clayey, hard to pack.
Klawasi--------	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, excess humus, wetness, thermokarst.	Severe: permafrost, wetness, too clayey.	Severe: permafrost, wetness, thermokarst.	Poor: permafrost, too clayey, wetness.
449*:					
Klutina--------	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy, small stones.
Klutina--------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy, large stones.	Severe: seepage.	Poor: seepage, too sandy, small stones.
450------------- Klutina	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy, large stones.	Severe: seepage.	Poor: seepage, too sandy, small stones.
451*:					
Klutina--------	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy, small stones.
Nizina---------	Severe: flooding, poor filter.	Severe: seepage, flooding, large stones.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy, small stones.
Klutina--------	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy, large stones.	Severe: seepage.	Poor: seepage, too sandy, small stones.
452, 453-------- Kuslina	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, seepage, excess humus.	Severe: permafrost, seepage, wetness.	Severe: permafrost, seepage, wetness.	Poor: permafrost, too sandy, wetness.
454------------- Mendeltna	Severe: permafrost, wetness, percs slowly.	Severe: permafrost, excess humus, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness, thermokarst.	Poor: permafrost, small stones, wetness.

*See footnote at end of table.

TABLE 9—SANITARY FACILITIES—Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
455, 456-------- Chetaslina	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey, large stones.	Slight---------	Poor: small stones.
457*:					
Mendeltna------	Severe: permafrost, wetness, percs slowly.	Severe: permafrost, excess humus, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness, thermokarst.	Poor: permafrost, small stones, wetness.
Tebay----------	Moderate: percs slowly.	Moderate: seepage, slope.	Slight---------	Slight---------	Poor: small stones.
458*:					
Nizina---------	Severe: flooding, poor filter.	Severe: seepage, flooding, large stones.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy, small stones.
Nizina---------	Severe: poor filter.	Severe: seepage, large stones.	Severe: seepage, too sandy, large stones.	Severe: seepage.	Poor: seepage, too sandy, small stones.
459------------- Pippin	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy, small stones.
460------------- Pippin	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, small stones.
461*: Riverwash.					
Nizina---------	Severe: flooding, poor filter.	Severe: seepage, flooding, large stones.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy, small stones.
462------------- Taral	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
463*:					
Taral----------	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
Hanagita-------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.

*See footnote at end of table.

TABLE 9—SANITARY FACILITIES—Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
464*:					
Strelna--------	Severe: permafrost, thermokarst, slope.	Severe: permafrost, seepage, slope.	Severe: permafrost, slope, excess humus.	Severe: permafrost, thermokarst, slope.	Poor: permafrost, hard to pack, slope.
Hanagita-------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope.
Copper River---	Severe: permafrost, wetness, slope.	Severe: permafrost, slope, excess humus.	Severe: permafrost, wetness, slope.	Severe: permafrost, wetness, slope.	Poor: permafrost, slope, wetness.
465------------- Tebay	Moderate: percs slowly.	Moderate: seepage, slope.	Slight---------	Slight---------	Poor: small stones.
466------------- Tebay	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Poor: small stones.
467------------- Tebay	Moderate: percs slowly.	Moderate: seepage, slope.	Slight---------	Slight---------	Poor: small stones.
468------------- Tebay	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Poor: small stones.
469------------- Tolsona	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, excess humus, thermokarst.	Severe: permafrost, wetness.	Severe: permafrost, wetness, thermokarst.	Poor: permafrost, wetness.
470------------- Tolsona	Severe: permafrost, wetness, slippage.	Severe: permafrost, slope, excess humus.	Severe: permafrost, wetness, slippage.	Severe: permafrost, wetness, slippage.	Poor: permafrost, wetness.
471, 472-------- Tsana	Moderate: percs slowly.	Moderate: seepage, slope.	Slight---------	Slight---------	Fair: small stones.
473------------- Tsana	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: small stones, slope.
474*:					
Tolsona--------	Severe: permafrost, wetness, thermokarst.	Severe: permafrost, excess humus, thermokarst.	Severe: permafrost, wetness.	Severe: permafrost, wetness, thermokarst.	Poor: permafrost, wetness.
Klanelneechena-	Severe: permafrost, wetness, poor filter.	Severe: permafrost, seepage, excess humus.	Severe: permafrost, seepage, wetness.	Severe: permafrost, seepage, wetness.	Poor: permafrost, too sandy, wetness.

*See footnote at end of table.

TABLE 9—SANITARY FACILITIES—Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
475------------- Wrangell	Severe: permafrost, wetness, percs slowly.	Severe: permafrost, seepage, excess humus.	Severe: permafrost, wetness, too clayey.	Severe: permafrost, seepage, wetness.	Poor: permafrost, too clayey, hard to pack.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10—CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the glossary [page 197]. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
401*. Badlands.				
402------------------- Chistochina	Good------------	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, small stones.
403, 404, 405, 406---- Copper River	Poor: permafrost, wetness.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, excess humus, wetness.
407, 408-------------- Kenny Lake	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, thin layer.
409------------------- Kenny Lake	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, thin layer, slope.
410------------------- Kenny Lake	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
411, 412-------------- Chitina	Fair: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Good.
413------------------- Chitina	Fair: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
414------------------- Chitina	Fair: thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
415, 416, 417--------- Tonsina	Good------------	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
418------------------- Tonsina	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
419*:				
Copper River---------	Poor: permafrost, wetness.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, excess humus, wetness.
Hanagita-------------	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
420*:				
Tonsina--------------	Good------------	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.

*See footnote at end of table.

TABLE 10—CONSTRUCTION MATERIALS—Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
420*: cont'd				
Hanagita-------------	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
421*:				
Cryochrepts.				
Rock outcrop.				
422*:				
Cryofibrists.				
Cryohemists.				
423.				
Cryohemists.				
424*:				
Cryorthents.				
Cryochrepts.				
425------------------- Dadina	Poor: permafrost.	Improbable: permafrost.	Improbable: permafrost.	Poor: permafrost, too sandy, small stones.
426*:				
Dadina---------------	Poor: permafrost.	Improbable: permafrost.	Improbable: permafrost.	Poor: permafrost, too sandy, small stones.
Klanelneechena-------	Poor: permafrost.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, too sandy.
427*:				
Dadina---------------	Poor: permafrost.	Improbable: permafrost.	Improbable: permafrost.	Poor: permafrost, too sandy, small stones.
Tolsona--------------	Poor: permafrost.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, small stones.
428*.				
Pits.				
429*, 430, 431-------- Gulkana	Fair: large stones.	Probable--------	Probable--------	Poor: too sandy, small stones, area reclaim.

*See footnote at end of table.

TABLE 10—CONSTRUCTION MATERIALS—Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
432------------------- Gulkana	Fair: large stones, slope.	Probable--------	Probable--------	Poor: too sandy, small stones, area reclaim.
433, 434, 435, 436, 437------------------ Klawasi	Poor: permafrost, low strength.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, too clayey.
438------------------- Klawasi	Poor: permafrost, low strength, wetness.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, too clayey, wetness.
439, 440, 441, 442, 443------------------ Gakona	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
444------------------- Gakona	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, slope.
445*:				
Klawasi--------------	Poor: permafrost, low strength.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, too clayey.
Tolsona--------------	Poor: permafrost.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, small stones.
446*:				
Gakona---------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
Stuck----------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy, small stones.
447*:				
Gakona---------------	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
Chetaslina-----------	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
448*:				
Klawasi--------------	Poor: permafrost, low strength.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, too clayey.

*See footnote at end of table.

TABLE 10—CONSTRUCTION MATERIALS—Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
448*: cont'd				
Wrangell-------------	Poor: permafrost, low strength, wetness.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, excess humus, wetness.
Klawasi--------------	Poor: permafrost, low strength, wetness.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, too clayey, wetness.
449*:				
Klutina--------------	Good------------	Probable--------	Probable--------	Poor: too sandy, small stones, area reclaim.
Klutina--------------	Fair: large stones.	Probable--------	Probable--------	Poor: too sandy, small stones, area reclaim.
450------------------- Klutina	Fair: large stones.	Probable--------	Probable--------	Poor: too sandy, small stones, area reclaim.
451*:				
Klutina--------------	Good------------	Probable--------	Probable--------	Poor: too sandy, small stones, area reclaim.
Nizina---------------	Fair: large stones.	Probable--------	Probable--------	Poor: too sandy, small stones, area reclaim.
Klutina--------------	Fair: large stones.	Probable--------	Probable--------	Poor: too sandy, small stones, area reclaim.
452, 453-------------- Kuslina	Poor: permafrost.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, excess humus.
454------------------- Mendeltna	Poor: permafrost.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, small stones.
455, 456-------------- Chetaslina	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
457*:				
Mendeltna------------	Poor: permafrost.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, small stones.

*See footnote at end of table.

TABLE 10—CONSTRUCTION MATERIALS—Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
457*: cont'd				
Tebay----------------	Good------------	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
458*:				
Nizina---------------	Fair: large stones.	Probable--------	Probable--------	Poor: too sandy, small stones, area reclaim.
Nizina---------------	Fair: large stones.	Probable--------	Probable--------	Poor: too sandy, small stones, area reclaim.
459------------------- Pippin	Good------------	Probable--------	Probable--------	Poor: too sandy, small stones, area reclaim.
460------------------- Pippin	Poor: slope.	Probable--------	Probable--------	Poor: too sandy, small stones, area reclaim.
461*:				
Riverwash.				
Nizina---------------	Fair: large stones.	Probable--------	Probable--------	Poor: too sandy, small stones, area reclaim.
462------------------- Taral	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
463*:				
Taral----------------	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Hanagita-------------	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
464*:				
Strelna--------------	Poor: permafrost, slope.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, excess humus, slope.
Hanagita-------------	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, slope.
Copper River---------	Poor: permafrost, wetness.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, excess humus, wetness.

*See footnote at end of table.

TABLE 10—CONSTRUCTION MATERIALS—Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
465, 466, 467, 468---- Tebay	Good------------	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
469, 470-------------- Tolsona	Poor: permafrost.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, small stones.
471, 472, 473--------- Tsana	Good------------	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
474*:				
Tolsona--------------	Poor: permafrost.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, small stones.
Klanelneechena-------	Poor: permafrost.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, too sandy.
475------------------- Wrangell	Poor: permafrost, low strength, wetness.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, excess humus, wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11—WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the glossary [page 197]. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Map symbol and soil name	Limitations for--	Features affecting--			
	Pond reservoir areas	Drainage	Irrigation	Terraces and diversions	Grassed waterways
401*. Badlands.					
402--------------- Chistochina	Severe: seepage.	Deep to water--	Slope, droughty, soil blowing.	Erodes easily, too sandy.	Erodes easily, droughty.
403--------------- Copper River	Severe: permafrost, pitting.	Permafrost, subsides, frost action.	Permafrost, wetness, pitting.	Permafrost, erodes easily.	Permafrost, wetness.
404--------------- Copper River	Severe: permafrost, pitting.	Permafrost, subsides, frost action.	Permafrost, wetness, slope.	Permafrost, erodes easily.	Permafrost, wetness.
405, 406---------- Copper River	Severe: permafrost, slippage, slope.	Permafrost, subsides, frost action.	Permafrost, wetness, slope.	Permafrost, slope, erodes easily.	Permafrost, wetness, slope.
407--------------- Kenny Lake	Moderate: seepage.	Deep to water--	Soil blowing, erodes easily.	Erodes easily, soil blowing.	Erodes easily.
408--------------- Kenny Lake	Moderate: seepage, slope.	Deep to water--	Slope, soil blowing, erodes easily.	Erodes easily, soil blowing.	Erodes easily.
409, 410---------- Kenny Lake	Severe: slope.	Deep to water--	Slope, soil blowing, erodes easily.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
411--------------- Chitina	Moderate: seepage.	Deep to water--	Soil blowing, erodes easily.	Erodes easily, soil blowing.	Erodes easily.
412--------------- Chitina	Moderate: seepage, slope.	Deep to water--	Slope, soil blowing, erodes easily.	Erodes easily, soil blowing.	Erodes easily.
413, 414---------- Chitina	Severe: slope.	Deep to water--	Slope, soil blowing, erodes easily.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
415--------------- Tonsina	Moderate: seepage.	Deep to water--	Soil blowing, erodes easily.	Erodes easily, soil blowing.	Erodes easily.
416--------------- Tonsina	Moderate: seepage, slope.	Deep to water--	Slope, soil blowing, erodes easily.	Erodes easily, soil blowing.	Erodes easily.
417, 418---------- Tonsina	Severe: slope.	Deep to water--	Slope, soil blowing, erodes easily.	Slope, erodes easily, soil blowing.	Slope, erodes easily.

*See footnote at end of table.

TABLE 11—WATER MANAGEMENT—Continued

Map symbol and soil name	Limitations for--	Features affecting--			
	Pond reservoir areas	Drainage	Irrigation	Terraces and diversions	Grassed waterways
419*:					
Copper River-----	Severe: permafrost, slippage, slope.	Permafrost, subsides, frost action.	Permafrost, wetness, slope.	Permafrost, slope, erodes easily.	Permafrost, wetness, slope.
Hanagita---------	Severe: depth to rock, slope.	Deep to water--	Slope, soil blowing, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
420*:					
Tonsina----------	Severe: slope.	Deep to water--	Slope, soil blowing, erodes easily.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
Hanagita---------	Severe: depth to rock, slope.	Deep to water--	Slope, soil blowing, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
421*:					
Cryochrepts.					
Rock outcrop.					
422*:					
Cryofibrists.					
Cryohemists.					
423.					
Cryohemists.					
424*:					
Cryorthents.					
Cryochrepts.					
425--------------- Dadina	Severe: permafrost, seepage.	Permafrost, subsides, large stones.	Permafrost, large stones.	Permafrost, large stones, erodes easily.	Permafrost, large stones, wetness.
426*:					
Dadina-----------	Severe: permafrost, seepage.	Permafrost, subsides, large stones.	Permafrost, large stones.	Permafrost, large stones, erodes easily.	Permafrost, large stones, wetness.
Klanelneechena---	Severe: permafrost, seepage.	Permafrost, subsides, frost action.	Permafrost, wetness.	Permafrost, erodes easily, wetness.	Permafrost, wetness, erodes easily.
427*:					
Dadina-----------	Severe: permafrost, seepage.	Permafrost, subsides, large stones.	Permafrost, large stones.	Permafrost, large stones, erodes easily.	Permafrost, large stones, wetness.
Tolsona----------	Severe: permafrost, pitting.	Permafrost, subsides, frost action.	Permafrost, wetness, pitting.	Permafrost, erodes easily.	Permafrost, wetness.

*See footnote at end of table.

TABLE 11—WATER MANAGEMENT—Continued

Map symbol and soil name	Limitations for--	Features affecting--			
	Pond reservoir areas	Drainage	Irrigation	Terraces and diversions	Grassed waterways
428*. Pits.					
429*-------------- Gulkana	Severe: seepage.	Deep to water--	Large stones, droughty.	Large stones, erodes easily.	Large stones, erodes easily.
430--------------- Gulkana	Severe: seepage.	Deep to water--	Slope, large stones, droughty.	Large stones, erodes easily.	Large stones, erodes easily.
431, 432---------- Gulkana	Severe: seepage, slope.	Deep to water--	Slope, large stones, droughty.	Slope, large stones, erodes easily.	Large stones, slope, erodes easily.
433--------------- Klawasi	Severe: permafrost, pitting.	Permafrost, subsides, frost action.	Permafrost, wetness, pitting.	Permafrost, erodes easily.	Permafrost, wetness.
434--------------- Klawasi	Severe: permafrost, pitting.	Permafrost, subsides, frost action.	Permafrost, slope, wetness.	Permafrost, erodes easily.	Permafrost, wetness.
435--------------- Klawasi	Severe: permafrost, slippage, slope.	Permafrost, subsides, frost action.	Permafrost, slope, wetness.	Permafrost, slope, erodes easily.	Permafrost, wetness, slope.
436--------------- Klawasi	Severe: permafrost, pitting.	Permafrost, subsides, frost action.	Permafrost, slope, wetness.	Permafrost, erodes easily.	Permafrost, wetness.
437--------------- Klawasi	Severe: permafrost, slippage, slope.	Permafrost, subsides, frost action.	Permafrost, slope, wetness.	Permafrost, slope, erodes easily.	Permafrost, wetness, slope.
438--------------- Klawasi	Severe: permafrost.	Permafrost, subsides, frost action.	Permafrost, wetness.	Permafrost, erodes easily, wetness.	Permafrost, wetness, erodes easily.
439--------------- Gakona	Moderate: seepage, slope.	Deep to water--	Slope, droughty, soil blowing.	Erodes easily, soil blowing.	Erodes easily, droughty.
440--------------- Gakona	Severe: slope.	Deep to water--	Slope, droughty, soil blowing.	Slope, erodes easily, soil blowing.	Slope, erodes easily, droughty.
441--------------- Gakona	Moderate: seepage.	Deep to water--	Droughty, soil blowing.	Erodes easily, soil blowing.	Erodes easily, droughty.
442--------------- Gakona	Moderate: seepage, slope.	Deep to water--	Slope, droughty, soil blowing.	Erodes easily, soil blowing.	Erodes easily, droughty.
443, 444---------- Gakona	Severe: slope.	Deep to water--	Slope, droughty, soil blowing.	Slope, erodes easily, soil blowing.	Slope, erodes easily, droughty.

*See footnote at end of table.

TABLE 11—WATER MANAGEMENT—Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
445*:					
Klawasi----------	Severe: permafrost, pitting.	Permafrost, subsides, frost action.	Permafrost, wetness, pitting.	Permafrost, erodes easily.	Permafrost, wetness.
Tolsona----------	Severe: permafrost, pitting.	Permafrost, subsides, frost action.	Permafrost, wetness, pitting.	Permafrost, erodes easily.	Permafrost, wetness.
446*:					
Gakona-----------	Moderate: seepage.	Deep to water--	Droughty, soil blowing.	Erodes easily, soil blowing.	Erodes easily, droughty.
Stuck------------	Severe: seepage.	Favorable------	Wetness, droughty.	Erodes easily, wetness, soil blowing.	Erodes easily, droughty.
447*:					
Gakona-----------	Moderate: seepage.	Deep to water--	Droughty, soil blowing.	Erodes easily, soil blowing.	Erodes easily, droughty.
Chetaslina-------	Moderate: seepage.	Deep to water--	Soil blowing, erodes easily.	Large stones, erodes easily, soil blowing.	Large stones, erodes easily.
448*:					
Klawasi----------	Severe: permafrost, pitting.	Permafrost, subsides, frost action.	Permafrost, wetness, pitting.	Permafrost, erodes easily.	Permafrost, wetness.
Wrangell---------	Severe: permafrost, seepage.	Permafrost, percs slowly, subsides.	Permafrost, wetness, percs slowly.	Permafrost, wetness, percs slowly.	Permafrost, wetness, percs slowly.
Klawasi----------	Severe: permafrost.	Permafrost, subsides, frost action.	Permafrost, wetness.	Permafrost, erodes easily, wetness.	Permafrost, wetness, erodes easily.
449*:					
Klutina----------	Severe: seepage.	Deep to water--	Droughty, soil blowing.	Large stones, erodes easily, too sandy.	Large stones, erodes easily, droughty.
Klutina----------	Severe: seepage.	Deep to water--	Large stones, droughty.	Large stones, erodes easily, too sandy.	Large stones, erodes easily, droughty.
450--------------- Klutina	Severe: seepage.	Deep to water--	Slope, large stones, droughty.	Large stones, erodes easily, too sandy.	Large stones, erodes easily, droughty.
451*:					
Klutina----------	Severe: seepage.	Deep to water--	Droughty, soil blowing.	Large stones, erodes easily, too sandy.	Large stones, erodes easily, droughty.
Nizina-----------	Severe: seepage.	Deep to water--	Large stones, droughty.	Large stones, too sandy, soil blowing.	Large stones, droughty.

*See footnote at end of table.

TABLE 11—WATER MANAGEMENT—Continued

Map symbol and soil name	Limitations for--	Features affecting--			
	Pond reservoir areas	Drainage	Irrigation	Terraces and diversions	Grassed waterways
451*: cont'd					
Klutina----------	Severe: seepage.	Deep to water--	Large stones, droughty.	Large stones, erodes easily, too sandy.	Large stones, erodes easily, droughty.
452--------------- Kuslina	Severe: permafrost, seepage, pitting.	Permafrost, subsides, frost action.	Permafrost, wetness, pitting.	Permafrost, erodes easily, wetness.	Permafrost, wetness, erodes easily.
453--------------- Kuslina	Severe: permafrost, seepage, pitting.	Permafrost, subsides, frost action.	Permafrost, slope, wetness.	Permafrost, erodes easily, wetness.	Permafrost, wetness, erodes easily.
454--------------- Mendeltna	Severe: permafrost, pitting.	Permafrost, subsides, frost action.	Permafrost, slope, wetness.	Permafrost, large stones, erodes easily.	Permafrost, large stones, wetness.
455, 456---------- Chetaslina	Moderate: seepage, slope.	Deep to water--	Slope, soil blowing, erodes easily.	Large stones, erodes easily, soil blowing.	Large stones, erodes easily.
457*:					
Mendeltna--------	Severe: permafrost, pitting.	Permafrost, subsides, frost action.	Permafrost, slope, wetness.	Permafrost, large stones, erodes easily.	Permafrost, large stones, wetness.
Tebay------------	Moderate: seepage, slope.	Deeo water-----	Slope, soil blowing, erodes easily.	Erodes easily, soil blowing.	Erodes easily.
458*:					
Nizina-----------	Severe: seepage.	Deep to water--	Large stones, droughty.	Large stones, too sandy, soil blowing.	Large stones, droughty.
Nizina-----------	Severe: seepage.	Deep to water--	Large stones, droughty.	Large stones, erodes easily, too sandy.	Large stones, erodes easily, droughty.
459--------------- Pippin	Severe: seepage.	Deep to water--	Slope, droughty, soil blowing.	Large stones, erodes easily.	Large stones, erodes easily.
460--------------- Pippin	Severe: seepage, slope.	Deep to water--	Slope, droughty, soil blowing.	Slope, large stones, erodes easily.	Large stones, slope, erodes easily.
461*:					
Riverwash.					
Nizina-----------	Severe: seepage.	Deep to water--	Large stones, droughty.	Large stones, too sandy, soil blowing.	Large stones, droughty.
462--------------- Taral	Severe: slope.	Deep to water--	Slope, soil blowing, erodes easily.	Slope, erodes easily, soil blowing.	Slope, erodes easily.

*See footnote at end of table.

TABLE 11—WATER MANAGEMENT—Continued

Map symbol and soil name	Limitations for--	Features affecting--			
	Pond reservoir areas	Drainage	Irrigation	Terraces and diversions	Grassed waterways
463*:					
Taral------------	Severe: slope.	Deep to water--	Slope, soil blowing, erodes easily.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
Hanagita---------	Severe: depth to rock, slope.	Deep to water--	Slope, soil blowing, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
464*:					
Strelna----------	Severe: permafrost, slippage, slope.	Deep to water--	Permafrost, slope, slippage.	Permafrost, slope, erodes easily.	Permafrost, slope, erodes easily.
Hanagita---------	Severe: depth to rock, slope.	Deep to water--	Slope, soil blowing, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Copper River-----	Severe: permafrost, slippage, slope.	Permafrost, subsides, frost action.	Permafrost, wetness, slope.	Permafrost, slope, erodes easily.	Permafrost, wetness, slope.
465--------------- Tebay	Moderate: seepage, slope.	Deep to water--	Slope, soil blowing, erodes easily.	Erodes easily, soil blowing.	Erodes easily.
466--------------- Tebay	Severe: slope.	Deep to water--	Slope, soil blowing, erodes easily.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
467--------------- Tebay	Moderate: seepage, slope.	Deep to water--	Slope, soil blowing, erodes easily.	Erodes easily, soil blowing.	Erodes easily.
468--------------- Tebay	Severe: slope.	Deep to water--	Slope, soil blowing, erodes easily.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
469--------------- Tolsona	Severe: permafrost, pitting.	Permafrost, subsides, frost action.	Permafrost, slope, wetness.	Permafrost, erodes easily.	Permafrost, wetness.
470--------------- Tolsona	Severe: permafrost, slippage, slope.	Permafrost, subsides, frost action.	Permafrost, slope, wetness.	Permafrost, slope, erodes easily.	Permafrost, wetness, slope.
471, 472---------- Tsana	Moderate: seepage, slope.	Deep to water--	Slope, soil blowing, erodes easily.	Erodes easily, soil blowing.	Erodes easily.
473--------------- Tsana	Severe: slope.	Deep to water--	Slope, soil blowing, erodes easily.	Slope, erodes easily, soil blowing.	Slope, erodes easily.

*See footnote at end of table.

TABLE 11—WATER MANAGEMENT—Continued

Map symbol and soil name	Limitations for-- Pond reservoir areas	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
474*:					
Tolsona----------	Severe: permafrost, pitting.	Permafrost, subsides, frost action.	Permafrost, slope, wetness.	Permafrost, erodes easily.	Permafrost, wetness.
Klanelneechena---	Severe: permafrost, seepage.	Permafrost, subsides, frost action.	Permafrost, slope, wetness.	Permafrost, erodes easily, wetness.	Permafrost, wetness, erodes easily.
475--------------- Wrangell	Severe: permafrost, seepage.	Permafrost, percs slowly, subsides.	Permafrost, wetness, percs slowly.	Permafrost, wetness, percs slowly.	Permafrost, wetness, percs slowly.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12—ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated.)

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments > 10 inches	Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
401*. Badlands.												
402---------	0-1	Silt loam-----	ML	A-4	0	0-5	95-100	90-100	85-100	70-85	25-30	NP-5
Chistochina	1-8	Fine sandy loam, gravelly sandy loam.	SM, ML	A-2, A-4	0	0-5	75-100	70-100	50-80	25-55	---	NP
	8-60	Fine sand, gravelly fine sand.	SM, SP-SM	A-2	0	0-15	80-95	65-95	55-70	10-20	---	NP
403, 404, 405, 406---	9-0	Peat----------	PT	A-8	0	0-10	---	---	---	---	---	---
Copper River	0-3	Silt loam, very fine sandy loam.	ML	A-4	0	0	100	100	95-100	75-100	25-30	NP-5
	3-60	Ice or frozen soil.	---	---	---	---	---	---	---	---	---	---
407, 408, 409, 410---	0-24	Silt loam-----	ML	A-4	0	0	100	100	95-100	65-85	25-30	NP-5
Kenny Lake	24-60	Silty clay, clay, silty clay loam.	CL, CH	A-6, A-7	0	0-5	90-100	85-100	85-95	70-90	35-60	15-40
411, 412, 413, 414---	0-2	Silt loam-----	ML	A-4	0	0	100	100	95-100	65-85	25-30	NP-5
Chitina	2-50	Silt, silt loam, very fine sandy loam.	ML	A-4	0	0	100	100	95-100	75-95	25-30	NP-5
	50-60	Silty clay, clay, silty clay loam.	CL, CH	A-6, A-7	0	0-5	90-100	85-100	85-95	70-90	35-60	15-40
415, 416, 417, 418---	0-15	Silt loam-----	ML	A-4	0	0	100	100	95-100	65-85	25-30	NP-5
Tonsina	15-60	Sandy loam, loam, gravelly sandy loam.	SM, ML	A-4, A-2	0	0-15	80-100	70-90	50-80	30-55	20-25	NP-5
419*: Copper River	9-0	Peat----------	PT	A-8	0	0-10	---	---	---	---	---	---
	0-3	Silt loam, very fine sandy loam.	ML	A-4	0	0	100	100	95-100	75-100	25-30	NP-5
	3-60	Ice or frozen soil	---	---	---	---	---	---	---	---	---	---

*See footnote at end of table.

TABLE 12—ENGINEERING INDEX PROPERTIES—Continued

Map symbol and soil name	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct	Pct					Pct	
419*: cont'd												
Hanagita----	0-7	Silt loam----	ML	A-4	0	0	100	100	95-100	70-90	25-30	NP-5
	7-15	Silt loam, very fine sandy loam.	ML	A-4	0	0	100	100	95-100	65-85	25-30	NP-5
	15-18	Gravelly silt loam, very channery sandy loam, very cobbly sandy loam.	GM, SM, ML	A-2, A-4	0-5	10-35	65-95	65-95	60-85	30-60	20-25	NP-5
	18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
420*:												
Tonsina-----	0-17	Silt loam----	ML	A-4	0	0	100	100	95-100	65-85	25-30	NP-5
	17-60	Sandy loam, loam, gravelly sandy loam.	SM, ML	A-4, A-2	0	0-15	80-100	70-90	50-80	30-55	20-25	NP-5
Hanagita----	0-7	Silt loam----	ML	A-4	0	0	100	100	95-100	70-90	25-30	NP-5
	7-15	Silt loam, very fine sandy loam.	ML	A-4	0	0	100	100	95-100	65-85	25-30	NP-5
	15-18	Gravelly silt loam, very channery sandy loam, very cobbly sandy loam.	GM, SM, ML	A-2, A-4	0-5	10-35	65-95	65-95	60-85	30-60	20-25	NP-5
	18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
421*:												
Cryochrepts.												
Rock outcrop.												
422*:												
Cryofibrists												
Cryohemists.												
423.												
Cryohemists.												
424*:												
Cryorthents.												
Cryochrepts.												
425---------	10-0	Peat---------	PT	A-8	0	0-10	---	---	---	---	---	---
Dadina	0-3	Silt loam, mucky silt loam.	MH, OH	A-5	0	0-5	95-100	90-100	90-100	80-90	60-80	NP-10

*See footnote at end of table.

TABLE 12—ENGINEERING INDEX PROPERTIES—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
425--------- Dadina cont'd	3-22	Very gravelly sand, extremely gravelly sand, extremely cobbly sand.	GP, GP-GM	A-1	0	10-45	30-45	25-40	15-30	0-5	---	NP
	22-60	Ice or frozen soil.	---	---	---	---	---	---	---	---	---	---
426*:												
Dadina------	10-0	Peat---------	PT	A-8	0	0-10	---	---	---	---	---	---
	0-3	Silt loam, mucky silt loam.	MH, OH	A-5	0	0-5	95-100	90-100	90-100	80-90	60-80	NP-10
	3-22	Very gravelly sand, extremely gravelly sand, extremely cobbly sand.	GP, GP-GM	A-1	0	10-45	30-45	25-40	15-30	0-5	---	NP
	22-60	Ice or frozen soil.	---	---	---	---	---	---	---	---	---	---
Klanelnee- chena------	12-0	Peat---------	PT	A-8	0	0-10	---	---	---	---	---	---
	0-1	Silt loam, mucky silt loam.	MH, OH	A-5	0	0	100	90-100	90-100	80-95	60-80	NP-10
	1-15	Sand, coarse sand.	SM	A-1, A-2	0	0-10	85-100	75-100	35-60	15-25	---	NP
	15-60	Ice or frozen soil.	---	---	---	---	---	---	---	---	---	---
427*:												
Dadina------	10-0	Peat---------	PT	A-8	0	0-10	---	---	---	---	---	---
	0-1	Silt loam, mucky silt loam.	MH, OH	A-5	0	0-5	95-100	90-100	90-100	80-90	60-80	NP-10
	1-27	Very gravelly sand, extremely gravelly sand, extremely cobbly sand.	GP, GP-GM	A-1	0	10-45	30-45	25-40	15-30	0-5	---	NP
	27-60	Ice or frozen soil.	---	---	---	---	---	---	---	---	---	---
Tolsona-----	8-0	Peat---------	PT	A-8	0	0-10	---	---	---	---	---	---
	0-1	Silt loam, mucky silt loam.	MH, OH	A-5	0	0	100	90-100	85-100	70-90	60-80	NP-10

*See footnote at end of table.

TABLE 12—ENGINEERING INDEX PROPERTIES—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
427*:												
Tolsona----- cont'd	1-19	Loam, fine sandy loam, gravelly sandy loam.	SM, ML	A-4	0	0-10	80-100	75-95	65-85	45-60	20-25	NP-5
	19-60	Ice or frozen soil.	---	---	---	---	---	---	---	---	---	---
428*. Pits.												
429*, 430, 431, 432--- Gulkana	0-14	Silt loam----	ML	A-4	0	0	100	95-100	90-100	75-90	25-30	NP-5
	14-60	Very gravelly sand, extremely cobbly sand, extremely gravelly sand.	GP-GM, SP-SM	A-1	0	10-45	50-65	25-55	15-35	5-10	---	NP
433, 434, 435, 436, 437, 438--- Klawasi	9-0	Peat---------	PT	A-8	0	0-10	---	---	---	---	---	---
	0-4	Silt loam, mucky silt loam.	MH, OH	A-5	0	0	100	90-100	85-100	70-90	60-80	NP-10
	4-14	Silty clay, clay, cobbly silty clay.	CL	A-6, A-7	0	0-15	90-100	85-100	80-95	75-90	30-50	15-35
	14-60	Ice or frozen soil.	---	---	---	---	---	---	---	---	---	---
439, 440, 441, 442, 443, 444--- Gakona	0-5	Silt loam---- -	ML	A-4, A-5	0	0	100	90-100	85-100	70-90	30-50	NP-10
	5-60	Silty clay, clay, cobbly silty clay.	CL	A-6, A-7	0	0-15	90-100	70-100	65-95	60-90	30-50	15-35
445*:												
Klawasi-----	10-0	Peat---------	PT	A-8	0	0-10	---	---	---	---	---	---
	0-1	Silt loam, mucky silt loam.	MH, OH	A-5	0	0	100	90-100	85-100	70-90	60-80	NP-10
	1-15	Silty clay, clay, cobbly silty clay.	CL	A-6, A-7	0	0-15	90-100	85-100	80-95	75-90	30-50	15-35
	15-60	Ice or frozen soil.	---	---	---	---	---	---	---	---	---	---
Tolsona-----	9-0	Peat---------	PT	A-8	0	0-10	---	---	---	---	---	---
	0-2	Silt loam, mucky silt loam.	MH, OH	A-5	0	0	100	90-100	85-100	70-90	60-80	NP-10

*See footnote at end of table.

TABLE 12—ENGINEERING INDEX PROPERTIES—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
445*:												
Tolsona----- cont'd	2-18	Loam, fine sandy loam, gravelly sandy loam.	SM, ML	A-4	0	0-10	80-100	75-95	65-85	45-60	20-25	NP-5
	18-60	Ice or frozen soil.	---	---	---	---	---	---	---	---	---	---
446*:												
Gakona------	0-2	Silt loam----	ML	A-4, A-5	0	0	100	90-100	85-100	70-90	30-50	NP-10
	2-60	Silty clay, clay, cobbly silty clay.	CL	A-6, A-7	0	0-15	90-100	70-100	65-95	60-90	30-50	15-35
Stuck-------	0-2	Silt loam----	ML	A-4, A-5	0	0	100	95-100	90-100	80-90	30-50	NP-10
	2-22	Loamy fine sand, coarse sand, sand.	SM	A-2, A-1	0	0-10	85-100	75-100	35-60	15-25	---	NP
	22-60	Silty clay, clay, cobbly silty clay.	CL, MH, ML, CH	A-7	0	0-20	90-100	70-100	70-95	60-90	40-55	15-25
447*:												
Gakona------	0-1	Silt loam----	ML	A-4, A-5	0	0	100	90-100	85-100	70-90	30-50	NP-10
	1-60	Silty clay, clay, cobbly silty clay.	CL	A-6, A-7	0	0-15	90-100	70-100	65-95	60-90	30-50	15-35
Chetaslina--	0-7	Silt loam----	ML	A-5	0	0-5	95-100	95-100	90-100	75-90	40-50	NP-5
	7-60	Clay loam, gravelly loam, cobbly loam.	CL	A-6	0	0-25	75-100	65-95	60-85	55-75	30-35	10-15
448*:												
Klawasi-----	9-0	Peat---------	PT	A-8	0	0-10	---	---	---	---	---	---
	0-3	Silt loam, mucky silt loam.	MH, OH	A-5	0	0	100	90-100	85-100	70-90	60-80	NP-10
	3-19	Silty clay, clay, cobbly silty clay.	CL	A-6, A-7	0	0-15	90-100	85-100	80-95	75-90	30-50	15-35
	19-60	Ice or frozen soil.	---	---	---	---	---	---	---	---	---	---
Wrangell----	0-23	Peat---------	PT	A-8	0	0-10	---	---	---	---	---	---
	23-37	Silty clay, clay.	CL, ML, MH, CH	A-7	0	0-5	90-100	85-100	85-95	75-90	40-55	15-25
	37-60	Ice or frozen soil.	---	---	---	---	---	---	---	---	---	---
Klawasi-----	12-0	Peat---------	PT	A-8	0	0-10	---	---	---	---	---	---

*See footnote at end of table.

TABLE 12—ENGINEERING INDEX PROPERTIES—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
448*:												
Klawasi----- cont'd	0-1	Silt loam, mucky silt loam.	MH, OH	A-5	0	0	100	90-100	85-100	70-90	60-80	NP-10
	1-17	Silty clay, clay, cobbly silty clay.	CL	A-6, A-7	0	0-15	90-100	85-100	80-95	75-90	30-50	15-35
	17-60	Ice or frozen soil.	---	---	---	---	---	---	---	---	---	---
449*:												
Klutina-----	0-3	Very fine sandy loam.	ML	A-4	0	0	100	95-100	85-100	60-75	15-20	NP-5
	3-25	Stratified silt loam to sand.	ML, SM	A-4	0	0-5	95-100	90-100	70-85	45-60	15-20	NP-5
	25-60	Very gravelly sand, extremely gravelly sand, extremely cobbly sand.	GP-GM, SP-SM	A-1	0-10	10-50	35-60	25-45	15-35	5-10	---	NP
Klutina-----	0-3	Silt loam----	ML	A-4	0	0	100	95-100	85-100	55-70	15-20	NP-5
	3-13	Stratified silt loam to sand.	ML, SM	A-4	0	0-5	95-100	90-100	70-85	45-60	15-20	NP-5
	13-60	Very gravelly sand, extremely gravelly sand, extremely cobbly sand.	GP-GM, SP-SM	A-1	0-10	10-50	35-60	25-45	15-35	5-10	---	NP
450--------- Klutina	0-2	Silt loam----	ML	A-4	0	0	100	95-100	85-100	55-70	15-20	NP-5
	2-13	Stratified silt loam to sand.	ML, SM	A-4	0	0-5	95-100	90-100	70-85	45-60	15-20	NP-5
	13-60	Very gravelly sand, extremely gravelly sand, extremely cobbly sand.	GP-GM, SP-SM	A-1	0-10	10-50	35-60	25-45	15-35	5-10	---	NP
451*:												
Klutina-----	0-3	Very fine sandy loam.	ML	A-4	0	0	100	95-100	85-100	60-75	15-20	NP-5
	3-25	Stratified silt loam to sand.	ML, SM	A-4	0	0-5	95-100	90-100	70-85	45-60	15-20	NP-5

*See footnote at end of table.

TABLE 12—ENGINEERING INDEX PROPERTIES—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
451*: Klutina----- cont'd	25-60	Very gravelly sand, extremely gravelly sand, extremely cobbly sand.	GP-GM, SP-SM	A-1	0-10	10-50	35-60	25-45	15-35	5-10	---	NP
Nizina------	0-4	Loamy fine sand.	SM	A-2, A-4	---	0-10	95-100	90-100	75-90	30-40	---	NP
	4-60	Very gravelly sand, extremely gravelly sand, extremely cobbly sand.	GP, GP-GM	A-1	0-10	10-50	35-50	25-45	15-30	0-10	---	NP
Klutina-----	0-3	Silt loam----	ML	A-4	0	0	100	95-100	85-100	55-70	15-20	NP-5
	3-13	Stratified silt loam to sand.	ML, SM	A-4	0	0-5	95-100	90-100	70-85	45-60	15-20	NP-5
	13-60	Very gravelly sand, extremely gravelly sand, extremely cobbly sand.	GP-GM, SP-SM	A-1	0-10	10-50	35-60	25-45	15-35	5-10	---	NP
452, 453---- Kuslina	10-0	Peat---------	PT	A-8	0	0-10	---	---	---	---	---	---
	0-4	Silt loam, mucky silt loam.	MH, OH	A-5	0	0	100	90-100	85-100	70-90	60-80	NP-10
	4-11	Stratified silt to sand.	ML, SM	A-4	0	0-5	95-100	90-100	65-80	40-60	15-20	NP-5
	11-60	Ice or frozen soil.	---	---	---	---	---	---	---	---	---	---
454--------- Mendeltna	9-0	Peat---------	PT	A-8	0	0-10	---	---	---	---	---	---
	0-2	Silt loam, mucky silt loam.	MH	A-5	0	0	100	100	95-100	75-90	60-80	NP-10
	2-16	Clay loam, gravelly loam, cobbly clay loam.	CL	A-6	0	0-25	75-100	65-95	60-85	55-75	30-35	10-15
	16-60	Ice or frozen soil.	---	---	---	---	---	---	---	---	---	---
455---------	0-7	Silt loam---- -	ML	A-5	0	0-5	95-100	95-100	90-100	75-90	40-50	NP-5
Chetaslina	7-60	Clay loam, gravelly loam, cobbly loam.	CL	A-6	0	0-25	75-100	65-95	60-85	55-75	30-35	10-15

*See footnote at end of table.

TABLE 12—ENGINEERING INDEX PROPERTIES—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
456--------- Chetaslina	0-1	Silt loam----	ML	A-5	0	0-5	95-100	95-100	90-100	75-90	40-50	NP-5
	1-60	Clay loam, gravelly loam, cobbly loam.	CL	A-6	0	0-25	75-100	65-95	60-85	55-75	30-35	10-15
457*: Mendeltna---	9-0	Peat---------	PT	A-8	0	0-10	---	---	---	---	---	---
	0-1	Silt loam, mucky silt loam.	MH	A-5	0	0	100	100	95-100	75-90	60-80	NP-10
	1-16	Clay loam, gravelly loam, cobbly clay loam.	CL	A-6	0	0-25	75-100	65-95	60-85	55-75	30-35	10-15
	16-60	Ice or frozen soil.	---	---	---	---	---	---	---	---	---	---
Tebay-------	0-2	Silt loam----	ML	A-4	0	0	100	100	95-100	70-90	25-30	NP-5
	2-60	Loam, fine sandy loam, gravelly sandy loam.	SM, ML	A-2, A-4	0	0-15	70-100	55-90	35-80	20-55	10-15	NP-5
458*: Nizina------	0-3	Loamy fine sand.	SM	A-2, A-4	---	0-10	95-100	90-100	75-90	30-40	---	NP
	3-60	Very gravelly sand, extremely gravelly sand, extremely cobbly sand.	GP, GP-GM	A-1	0-10	10-50	35-50	25-45	15-30	0-10	---	NP
Nizina------	0-4	Very fine sandy loam.	ML	A-4	0	0	100	100	95-100	60-75	25-30	NP-5
	4-60	Very gravelly sand, extremely gravelly sand, extremely cobbly sand.	GP, GP-GM	A-1	0-10	10-50	35-50	25-45	15-30	0-10	---	NP
459, 460---- Pippin	0-8	Silt loam----	ML	A-4	0	0	100	95-100	95-100	80-90	25-30	NP-5
	8-60	Very gravelly sand, extremely gravelly sand, extremely cobbly coarse sand.	GP	A-1	0	15-30	40-50	20-45	10-25	0-5	---	NP
461*: Riverwash.												

*See footnote at end of table.

TABLE 12—ENGINEERING INDEX PROPERTIES—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 10 inches	Fragments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
461*: cont'd												
Nizina------	0-4	Loamy fine sand.	SM	A-2, A-4	---	0-10	95-100	90-100	75-90	30-40	---	NP
	4-60	Very gravelly sand, extremely gravelly sand, extremely cobbly sand.	GP, GP-GM	A-1	0-10	10-50	35-50	25-45	15-30	0-10	---	NP
462--------- Taral	0-3	Mucky silt loam.	ML, OL	A-4	0	0	100	100	95-100	65-85	25-30	NP-5
	3-28	Mucky silt loam, silt loam.	ML	A-4	0	0	100	100	95-100	65-85	25-30	NP-5
	28-60	Sandy loam, loam, gravelly sandy loam.	ML, SM	A-4	0	0-20	80-100	65-90	65-85	40-55	20-25	NP-5
463*:												
Taral-------	0-2	Mucky silt loam.	ML, OL	A-4	0	0	100	100	95-100	65-85	25-30	NP-5
	2-22	Mucky silt loam, silt loam.	ML	A-4	0	0	100	100	95-100	65-85	25-30	NP-5
	22-60	Sandy loam, loam, gravelly sandy loam.	ML, SM	A-4	0	0-20	80-100	65-90	65-85	40-55	20-25	NP-5
Hanagita----	0-7	Silt loam----	ML	A-4	0	0	100	100	95-100	70-90	25-30	NP-5
	7-15	Silt loam, very fine sandy loam.	ML	A-4	0	0	100	100	95-100	65-85	25-30	NP-5
	15-18	Gravelly silt loam, very channery sandy loam, very cobbly sandy loam.	GM, SM, ML	A-2, A-4	0-5	10-35	65-95	65-95	60-85	30-60	20-25	NP-5
	18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
464*:												
Strelna-----	13-0	Peat---------	PT	A-8	0	0-10	---	---	---	---	---	---
	0-10	Stratified mucky silt loam to very fine sandy loam.	ML, OL	A-4	0	0	100	100	95-100	75-90	25-30	NP-5
	10-60	Ice or frozen soil.	---	---	---	---	---	---	---	---	---	---

*See footnote at end of table.

TABLE 12—ENGINEERING INDEX PROPERTIES—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
464*: cont'd Hanagita----	0-7	Silt loam----	ML	A-4	0	0	100	100	95-100	70-90	25-30	NP-5
	7-15	Silt loam, very fine sandy loam.	ML	A-4	0	0	100	100	95-100	65-85	25-30	NP-5
	15-18	Gravelly silt loam, very channery sandy loam, very cobbly sandy loam.	GM, SM, ML	A-2, A-4	0-5	10-35	65-95	65-95	60-85	30-60	20-25	NP-5
	18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	---
Copper River	9-0	Peat--------- -	PT	A-8	0	0-10	---	---	---	---	---	---
	0-4	Silt loam, very fine sandy loam.	ML	A-4	0	0	100	100	95-100	75-100	25-30	NP-5
	4-60	Ice or frozen soil.	---	---	---	---	---	---	---	---	---	---
465, 466---- Tebay	0-4	Silt loam----	ML	A-4	0	0	100	100	95-100	70-90	25-30	NP-5
	4-60	Loam, fine sandy loam, gravelly sandy loam.	SM, ML	A-2, A-4	0	0-15	70-100	55-90	35-80	20-55	10-15	NP-5
467, 468---- Tebay	0-1	Silt loam----	ML	A-4	0	0	100	100	95-100	70-90	25-30	NP-5
	1-60	Loam, fine sandy loam, gravelly sandy loam.	SM, ML	A-2, A-4	0	0-15	70-100	55-90	35-80	20-55	10-15	NP-5
469, 470---- Tolsona	8-0	Peat---------	PT	A-8	0	0-10	---	---	---	---	---	---
	0-3	Silt loam, mucky silt loam.	MH, OH	A-5	0	0	100	90-100	85-100	70-90	60-80	NP-10
	3-24	Loam, fine sandy loam, gravelly sandy loam.	SM, ML	A-4	0	0-10	80-100	75-95	65-85	45-60	20-25	NP-5
	24-60	Ice or frozen soil.	---	---	---	---	---	---	---	---	---	---
471--------- Tsana	0-3	Silt loam----	ML	A-4, A-5	0	0	100	90-100	85-100	70-90	30-50	NP-10
	3-60	Sandy loam, fine sandy loam, gravelly loam.	SM, ML	A-4	0	0-10	80-100	70-95	65-85	45-60	20-25	NP-5
472, 473---- Tsana	0-3	Silt loam----	ML	A-4, A-5	0	0	100	90-100	85-100	70-90	30-50	NP-10

*See footnote at end of table.

TABLE 12—ENGINEERING INDEX PROPERTIES—Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag- ments > 10 inches	Frag- ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO			4	10	40	200		
	In				Pct	Pct					Pct	
472, 473---- Tsana cont'd	3-60	Sandy loam, fine sandy loam, gravelly loam.	SM, ML	A-4	0	0-10	80-100	70-95	65-85	45-60	20-25	NP-5
474*: Tolsona-----	9-0	Peat----------	PT	A-8	0	0-10	---	---	---	---	---	---
	0-2	Silt loam, mucky silt loam.	MH, OH	A-5	0	0	100	90-100	85-100	70-90	60-80	NP-10
	2-27	Loam, fine sandy loam, gravelly sandy loam.	SM, ML	A-4	0	0-10	80-100	75-95	65-85	45-60	20-25	NP-5
	27-60	Ice or frozen soil.	---	---	---	---	---	---	---	---	---	---
Klanelnee- chena------	11-0	Peat----------	PT	A-8	0	0-10	---	---	---	---	---	---
	0-2	Silt loam, mucky silt loam.	MH, OH	A-5	0	0	100	90-100	90-100	80-95	60-80	NP-10
	2-18	Sand, coarse sand.	SM	A-1, A-2	0	0-10	85-100	75-100	35-60	15-25	---	NP
	18-60	Ice or frozen soil.	---	---	---	---	---	---	---	---	---	---
475---------	0-23	Peat----------	PT	A-8	0	0-10	---	---	---	---	---	---
Wrangell	23-37	Silty clay, clay.	CL, ML, MH, CH	A-7	0	0-5	90-100	85-100	85-95	75-90	40-55	15-25
	37-60	Ice or frozen soil.	---	---	---	---	---	---	---	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13—PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or was not estimated.)

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Shrink- swell potential	Erosion factors K	Erosion factors T	Wind erodi- bility group	Organic matter
	In	Pct	G/cc	In/hr	In/in	pH					Pct
401*. Badlands.											
402-------------- Chistochina	0-1	0-10	0.95-1.15	0.6-2.0	0.21-0.23	6.1-7.3	Low-----	0.37	5	1	3-6
	1-8	5-15	1.25-1.35	2.0-6.0	0.14-0.16	6.1-7.3	Low-----	0.15			
	8-60	0-5	1.40-1.55	6.0-20	0.06-0.08	6.6-7.8	Low-----	0.02			
403, 404, 405, 406------------- Copper River	9-0	---	0.10-0.20	2.0-6.0	0.32-0.35	5.1-6.5	Low-----	0.05	1	8	65-85
	0-3	5-10	0.95-1.15	0.6-2.0	0.17-0.20	6.6-7.8	Low-----	0.37			
	3-60	---	---	---	---	---	--------	----			
407, 408, 409, 410------------- Kenny Lake	0-24	5-10	0.95-1.15	0.6-2.0	0.17-0.20	6.6-7.8	Low-----	0.37	5	1	3-6
	24-60	40-75	1.35-1.60	0.6-2.0	0.06-0.12	7.4-8.4	Moderate--	0.64			
411, 412, 413, 414------------- Chitina	0-2	5-10	0.95-1.15	0.6-2.0	0.17-0.20	6.6-7.8	Low-----	0.37	5	1	3-6
	2-50	5-10	0.95-1.15	0.6-2.0	0.17-0.20	6.6-7.8	Low-----	0.43			
	50-60	40-75	1.35-1.60	0.6-2.0	0.06-0.12	7.4-8.4	Moderate	0.64			
415, 416, 417, 418------------- Tonsina	0-15	5-10	0.95-1.15	0.6-2.0	0.17-0.20	6.1-7.8	Low-----	0.37	1	1	3-6
	15-60	5-15	1.30-1.50	0.6-2.0	0.12-0.15	6.6-8.4	Low-----	0.28			
419*:											
Copper River----	9-0	---	0.10-0.20	2.0-6.0	0.32-0.35	5.1-6.5	Low-----	0.05	1	8	65-85
	0-3	5-10	0.95-1.15	0.6-2.0	0.17-0.20	6.6-7.8	Low-----	0.37			
	3-60	---	---	---	---	---	--------	---			
Hanagita--------	0-7	5-10	0.90-1.15	0.6-2.0	0.17-0.20	6.6-7.3	Low-----	0.37	1	1	3-6
	7-15	5-10	0.90-1.15	0.6-2.0	0.17-0.20	6.6-7.3	Low-----	0.43			
	15-18	5-15	1.50-1.60	0.6-2.0	0.12-0.14	6.6-7.3	Low-----	0.17			
	18	---	---	---	---	---	--------	---			
420*:											
Tonsina---------	0-17	5-10	0.95-1.15	0.6-2.0	0.17-0.20	6.1-7.8	Low-----	0.37	1	1	3-6
	17-60	5-15	1.30-1.50	0.6-2.0	0.12-0.15	6.6-8.4	Low-----	0.28			
Hanagita--------	0-7	5-10	0.90-1.15	0.6-2.0	0.17-0.20	6.6-7.3	Low-----	0.37	1	1	3-6
	7-15	5-10	0.90-1.15	0.6-2.0	0.17-0.20	6.6-7.3	Low-----	0.43			
	15-18	5-15	1.50-1.60	0.6-2.0	0.12-0.14	6.6-7.3	Low-----	0.17			
	18	---	---	---	---	---	--------	----			
421*:											
Cryochrepts.											
Rock outcrop.											
422*:											
Cryofibrists.											
Cryohemists.											

*See footnote at end of table.

TABLE 13—PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS—Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reactio n	Shrink- swell potential	Erosion factors		Wind erodi- bility group	Organic matter
								K	T		
	In	Pct	G/cc	In/hr	In/in	pH					Pct
423. Cryohemists.											
424*: Cryorthents.											
Cryochrepts.											
425-------------- Dadina	10-0	0-3	0.05-0.15	2.0-6.0	0.32-0.35	5.1-6.5	Low------	0.05	1	8	65-85
	0-3	5-10	0.95-1.15	0.6-2.0	0.22-0.25	6.1-7.3	Low------	0.37			
	3-22	0-5	1.60-1.70	>20	0.02-0.04	6.1-7.3	Low------	0.02			
	22-60	---	---	---	---	---	---------	----			
426*: Dadina----------	10-0	0-3	0.05-0.15	2.0-6.0	0.32-0.35	5.1-6.5	Low------	0.05	1	8	65-85
	0-3	5-10	0.95-1.15	0.6-2.0	0.22-0.25	6.1-7.3	Low------	0.37			
	3-22	0-5	1.60-1.70	>20	0.02-0.04	6.1-7.3	Low------	0.02			
	22-60	---	---	---	---	---	---------	----			
Klanelneechena--	12-0	0-3	0.05-0.15	2.0-6.0	0.32-0.35	5.6-6.5	Low------	0.05	1	8	65-85
	0-1	0-10	0.95-1.15	0.6-2.0	0.22-0.24	6.1-7.3	Low------	0.37			
	1-15	0-5	1.40-1.55	6.0-20	0.04-0.06	6.1-7.3	Low------	0.02			
	15-60	---	---	---	---	---	---------	----			
427*: Dadina----------	10-0	0-3	0.05-0.15	2.0-6.0	0.32-0.35	5.1-6.5	Low------	0.05	1	8	65-85
	0-1	5-10	0.95-1.15	0.6-2.0	0.22-0.25	6.1-7.3	Low------	0.37			
	1-27	0-5	1.60-1.70	>20	0.02-0.04	6.1-7.3	Low------	0.02			
	27-60	---	---	---	---	---	---------	----			
Tolsona---------	8-0	0-3	0.05-0.15	2.0-6.0	0.32-0.35	5.6-6.5	Low------	0.05	2	8	65-85
	0-1	5-10	0.95-1.15	0.6-2.0	0.22-0.25	6.1-7.3	Low------	0.37			
	1-19	5-15	1.45-1.55	0.6-2.0	0.12-0.15	6.6-7.8	Low------	0.28			
	19-60	---	---	---	---	---	---------	----			
428*. Pits.											
429*, 430, 431, 432------------- Gulkana	0-14	5-10	0.95-1.15	0.6-2.0	0.21-0.23	6.6-7.8	Low------	0.37	1	1	3-6
	14-60	0-5	1.50-1.60	6.0-20	0.03-0.06	6.6-8.4	Low------	0.10			
433, 434, 435, 436, 437-------- Klawasi	9-0	0-3	0.05-0.10	2.0-6.0	0.32-0.35	5.6-6.5	Low------	0.05	2	8	65-90
	0-4	5-10	0.95-1.15	0.6-2.0	0.22-0.25	6.1-7.8	Low------	0.37			
	4-14	40-75	1.40-1.60	0.6-2.0	0.06-0.12	7.4-8.4	Moderate-	0.17			
	14-60	---	---	---	---	---	---------	----			
438-------------- Klawasi	9-0	0-3	0.05-0.15	2.0-6.0	0.32-0.35	5.6-6.5	Low------	0.05	2	8	65-90
	0-4	5-10	0.95-1.15	0.6-2.0	0.22-0.25	6.1-7.8	Low------	0.37			
	4-14	40-75	1.40-1.60	0.6-2.0	0.06-0.12	7.4-8.4	Moderate-	0.17			
	14-60	---	---	---	---	---	---------	----			
439, 440, 441, 442, 443, 444--- Gakona	0-5	5-10	0.95-1.15	0.6-2.0	0.17-0.20	6.1-7.3	Low------	0.37	5	1	2-8
	5-60	60-75	1.30-1.40	0.6-2.0	0.06-0.12	7.4-8.4	Moderate-	0.17			

*See footnote at end of table.

TABLE 13—PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS—Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Shrink- swell potential	Erosion factors		Wind erodi- bility group	Organic matter
								K	T		
	In	Pct	G/cc	In/hr	In/in	pH					Pct
445*:											
Klawasi------	10-0	0-3	0.05-0.10	2.0-6.0	0.32-0.35	5.6-6.5	Low------	0.05	2	8	65-90
	0-1	5-10	0.95-1.15	0.6-2.0	0.22-0.25	6.1-7.8	Low------	0.37			
	1-15	40-75	1.40-1.60	0.6-2.0	0.06-0.12	7.4-8.4	Moderate-	0.17			
	15-60	---	---	---	---	---	---------	----			
Tolsona------	9-0	0-3	0.05-0.15	2.0-6.0	0.32-0.35	5.6-6.5	Low------	0.05	2	8	65-85
	0-2	5-10	0.95-1.15	0.6-2.0	0.22-0.25	6.1-7.3	Low------	0.37			
	2-18	5-15	1.45-1.55	0.6-2.0	0.12-0.15	6.6-7.8	Low------	0.28			
	18-60	---	---	---	---	---	---------	----			
446*:											
Gakona-------	0-2	5-10	0.95-1.15	0.6-2.0	0.17-0.20	6.1-7.3	Low------	0.37	5	1	2-8
	2-60	60-75	1.30-1.40	0.6-2.0	0.06-0.12	7.4-8.4	Moderate-	0.17			
Stuck--------	0-2	5-10	0.95-1.15	0.6-2.0	0.22-0.24	6.1-7.3	Low------	0.37	2	1	6-12
	2-22	0-5	1.30-1.50	6.0-20	0.04-0.06	6.1-7.3	Low------	0.10			
	22-60	35-55	1.40-1.60	0.2-0.6	0.06-0.12	7.4-8.4	Moderate-	0.28			
447*:											
Gakona-------	0-1	5-10	0.95-1.15	0.6-2.0	0.17-0.20	6.1-7.3	Low------	0.37	5	1	2-8
	1-60	60-75	1.30-1.40	0.6-2.0	0.06-0.12	7.4-8.4	Moderate-	0.17			
Chetaslina---	0-7	0-10	0.95-1.15	0.6-2.0	0.17-0.20	6.6-7.8	Low------	0.37	5	1	2-8
	7-60	20-35	1.30-1.50	0.6-2.0	0.14-0.16	7.4-8.4	Moderate-	0.32			
448*:											
Klawasi------	9-0	0-3	0.05-0.10	2.0-6.0	0.32-0.35	5.6-6.5	Low------	0.05	2	8	65-90
	0-3	5-10	0.95-1.15	0.6-2.0	0.22-0.25	6.1-7.8	Low------	0.37			
	3-19	40-75	1.40-1.60	0.6-2.0	0.06-0.12	7.4-8.4	Moderate-	0.17			
	19-60	---	---	---	---	---	---------	----			
Wrangell-----	0-23	0-3	0.10-0.15	2.0-6.0	0.32-0.35	5.6-7.3	Low------	0.05	2	8	65-85
	23-37	40-75	1.50-1.60	0.06-0.2	0.06-0.12	7.4-8.4	Moderate-	0.24			
	37-60	---	---	---	---	---	---------	----			
Klawasi------	12-0	0-3	0.05-0.15	2.0-6.0	0.32-0.35	5.6-6.5	Low------	0.05	2	8	65-90
	0-1	5-10	0.95-1.15	0.6-2.0	0.22-0.25	6.1-7.8	Low------	0.37			
	1-17	40-75	1.40-1.60	0.6-2.0	0.06-0.12	7.4-8.4	Moderate-	0.17			
	17-60	---	---	---	---	---	---------	----			
449*:											
Klutina------	0-3	0-10	1.10-1.20	0.6-2.0	0.13-0.16	6.1-7.3	Low------	0.37	2	3	3-6
	3-25	0-10	1.10-1.20	0.6-2.0	0.13-0.16	6.1-7.3	Low------	0.37			
	25-60	0-5	1.40-1.50	6.0-20	0.03-0.06	6.6-8.4	Low------	0.10			
Klutina------	0-3	0-10	1.10-1.20	0.6-2.0	0.13-0.16	6.1-7.3	Low------	0.37	1	3	3-6
	3-13	0-10	1.10-1.20	0.6-2.0	0.13-0.16	6.1-7.3	Low------	0.37			
	13-60	0-5	1.40-1.50	6.0-20	0.03-0.06	6.6-8.4	Low------	0.10			
450----------- Klutina	0-2	0-10	1.10-1.20	0.6-2.0	0.13-0.16	6.1-7.3	Low------	0.37	1	3	3-6
	2-13	0-10	1.10-1.20	0.6-2.0	0.13-0.16	6.1-7.3	Low------	0.37			
	13-60	0-5	1.40-1.50	6.0-20	0.03-0.06	6.6-8.4	Low------	0.10			

*See footnote at end of table.

TABLE 13—PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS—Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Shrink- swell potential	Erosion factors		Wind erodi- bility group	Organic matter
								K	T		
	In	Pct	G/cc	In/hr	In/in	pH					Pct
451*:											
Klutina------	0-3	0-10	1.10-1.20	0.6-2.0	0.13-0.16	6.1-7.3	Low-------	0.37	2	3	3-6
	3-25	0-10	1.10-1.20	0.6-2.0	0.13-0.16	6.1-7.3	Low-------	0.37			
	25-60	0-5	1.40-1.50	6.0-20	0.03-0.06	6.6-8.4	Low-------	0.10			
Nizina-------	0-4	0-5	1.30-1.50	2.0-6.0	0.11-0.14	6.6-7.8	Low-------	0.15	5	2	1-3
	4-60	0-5	1.60-1.70	6.0-20	0.03-0.08	6.6-8.4	Low-------	0.10			
Klutina------	0-3	0-10	1.10-1.20	0.6-2.0	0.13-0.16	6.1-7.3	Low-------	0.37	1	3	3-6
	3-13	0-10	1.10-1.20	0.6-2.0	0.13-0.16	6.1-7.3	Low-------	0.37			
	13-60	0-5	1.40-1.50	6.0-20	0.03-0.06	6.6-8.4	Low-------	0.10			
452, 453------ Kuslina	10-0	0-3	0.05-0.15	2.0-6.0	0.32-0.35	5.1-6.0	Low-------	0.05	2	8	65-85
	0-4	5-10	0.95-1.15	0.6-2.0	0.22-0.25	6.6-8.4	Low-------	0.37			
	4-11	0-10	1.25-1.45	2.0-6.0	0.13-0.16	6.6-8.4	Low-------	0.24			
	11-60	---	---	---	---	---	----------	----			
454----------- Mendeltna	9-0	0-3	0.05-0.15	2.0-6.0	0.32-0.35	5.1-6.0	Low-------	0.05	2	8	65-85
	0-2	0-10	0.95-1.15	0.6-2.0	0.22-0.24	6.6-7.8	Low-------	0.37			
	2-16	20-35	1.30-1.50	0.6-2.0	0.14-0.16	7.4-8.4	Moderate--	0.32			
	16-60	---	---	---	---	---	----------	----			
455----------- Chetaslina	0-7	0-10	0.95-1.15	0.6-2.0	0.17-0.20	6.6-7.8	Low-------	0.37	5	1	2-8
	7-60	20-35	1.30-1.50	0.6-2.0	0.14-0.16	7.4-8.4	Moderate--	0.32			
456----------- Chetaslina	0-1	0-10	0.95-1.15	0.6-2.0	0.17-0.20	6.6-7.8	Low-------	0.37	5	1	2-8
	1-60	20-35	1.30-1.50	0.6-2.0	0.14-0.16	7.4-8.4	Moderate--	0.32			
457*:											
Mendeltna----	9-0	0-3	0.05-0.15	2.0-6.0	0.32-0.35	5.1-6.0	Low-------	0.05	2	8	65-85
	0-1	0-10	0.95-1.15	0.6-2.0	0.22-0.24	6.6-7.8	Low-------	0.37			
	1-16	20-35	1.30-1.50	0.6-2.0	0.14-0.16	7.4-8.4	Moderate--	0.32			
	16-60	---	---	---	---	---	----------	----			
Tebay--------	0-2	5-10	0.95-1.15	0.6-2.0	0.17-0.20	6.1-7.3	Low-------	0.37	5	1	3-6
	2-60	5-10	1.30-1.40	0.6-2.0	0.12-0.15	6.6-7.8	Low-------	0.28			
458*:											
Nizina-------	0-3	0-5	1.30-1.50	2.0-6.0	0.11-0.14	6.6-7.8	Low-------	0.15	5	2	1-3
	3-60	0-5	1.60-1.70	6.0-20	0.03-0.08	6.6-8.4	Low-------	0.10			
Nizina-------	0-4	5-10	0.95-1.15	0.6-2.0	0.16-0.20	6.6-7.8	Low-------	0.37	5	2	3-6
	4-60	0-5	1.60-1.70	6.0-20	0.03-0.06	6.6-8.4	Low-------	0.10			
459, 460------ Pippin	0-8	5-10	0.95-1.15	0.6-2.0	0.17-0.20	6.1-7.8	Low-------	0.37	5	1	3-6
	8-60	0-5	1.50-1.60	6.0-20	0.02-0.04	6.6-8.4	Low-------	0.02			
461*:											
Riverwash.											
Nizina-------	0-4	0-5	1.30-1.50	2.0-6.0	0.11-0.14	6.6-7.8	Low-------	0.15	5	2	1-3
	4-60	0-5	1.60-1.70	6.0-20	0.03-0.08	6.6-8.4	Low-------	0.10			
462----------- Taral	0-3	5-10	0.95-1.15	0.6-2.0	0.22-0.24	6.1-7.3	Low-------	0.37	2	1	14-20
	3-28	5-10	0.95-1.15	0.6-2.0	0.22-0.24	6.6-7.8	Low-------	0.37			
	28-60	5-15	1.30-1.50	0.6-2.0	0.12-0.15	6.6-7.8	Low-------	0.28			

*See footnote at end of table.

TABLE 13—PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS—Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Shrink- swell potential	Erosion factors		Wind erodi- bility group	Organic matter
								K	T		
	In	Pct	G/cc	In/hr	In/in	pH					Pct
463*:											
Taral--------	0-2	5-10	0.95-1.15	0.6-2.0	0.22-0.24	6.1-7.3	Low-------	0.37	2	1	14-20
	2-22	5-10	0.95-1.15	0.6-2.0	0.22-0.24	6.6-7.8	Low-------	0.37			
	22-60	5-15	1.30-1.50	0.6-2.0	0.12-0.15	6.6-7.8	Low-------	0.28			
Hanagita-----	0-7	5-10	0.90-1.15	0.6-2.0	0.17-0.20	6.6-7.3	Low-------	0.37	1	1	3-6
	7-15	5-10	0.90-1.15	0.6-2.0	0.17-0.20	6.6-7.3	Low-------	0.43			
	15-18	5-15	1.50-1.60	0.6-2.0	0.12-0.14	6.6-7.3	Low-------	0.17			
	18	---	---	---	---	---	----------	----			
464*:											
Strelna------	13-0	0-3	0.05-0.20	2.0-6.0	0.32-0.35	5.1-6.5	Low-------	0.05	2	8	65-85
	0-10	5-10	0.95-1.15	0.6-2.0	0.22-0.24	6.6-7.8	Low-------	0.37			
	10-60	---	---	---	---	---	----------	----			
464*:											
Hanagita-----	0-7	5-10	0.90-1.15	0.6-2.0	0.17-0.20	6.6-7.3	Low-------	0.37	1	1	3-6
	7-15	5-10	0.90-1.15	0.6-2.0	0.17-0.20	6.6-7.3	Low-------	0.43			
	15-18	5-15	1.50-1.60	0.6-2.0	0.12-0.14	6.6-7.3	Low-------	0.17			
	18	---	---	---	---	---	----------	----			
Copper River-	9-0	---	0.10-0.20	2.0-6.0	0.32-0.35	5.1-6.5	Low-------	0.05	1	8	65-85
	0-4	5-10	0.95-1.15	0.6-2.0	0.17-0.20	6.6-7.8	Low-------	0.37			
	4-60	---	---	---	---	---	----------	----			
465, 466------ Tebay	0-4	5-10	0.95-1.15	0.6-2.0	0.17-0.20	6.1-7.3	Low-------	0.37	5	1	3-6
	4-60	5-10	1.30-1.40	0.6-2.0	0.12-0.15	6.6-7.8	Low-------	0.28			
467, 468------ Tebay	0-1	5-10	0.95-1.15	0.6-2.0	0.17-0.20	6.1-7.3	Low-------	0.37	5	1	3-6
	1-60	5-10	1.30-1.40	0.6-2.0	0.12-0.15	6.6-7.8	Low-------	0.28			
469, 470------ Tolsona	8-0	0-3	0.05-0.15	2.0-6.0	0.32-0.35	5.6-6.5	Low-------	0.05	2	8	65-85
	0-3	5-10	0.95-1.15	0.6-2.0	0.22-0.25	6.1-7.3	Low-------	0.37			
	3-24	5-15	1.45-1.55	0.6-2.0	0.12-0.15	6.6-7.8	Low-------	0.28			
	24-60	---	---	---	---	---	----------	----			
471----------- Tsana	0-3	5-10	0.95-1.15	0.6-2.0	0.22-0.25	6.1-7.3	Low-------	0.37	5	1	2-8
	3-60	5-15	1.45-1.55	0.6-2.0	0.12-0.15	6.1-7.3	Low-------	0.28			
472, 473------ Tsana	0-3	5-10	0.95-1.15	0.6-2.0	0.22-0.25	6.1-7.3	Low-------	0.37	5	1	2-8
	3-60	5-15	1.45-1.55	0.6-2.0	0.12-0.15	6.1-7.3	Low-------	0.28			
474*:											
Tolsona------	9-0	0-3	0.05-0.15	2.0-6.0	0.32-0.35	5.6-6.5	Low-------	0.05	2	8	65-85
	0-2	5-10	0.95-1.15	0.6-2.0	0.22-0.25	6.1-7.3	Low-------	0.37			
	2-27	5-15	1.45-1.55	0.6-2.0	0.12-0.15	6.6-7.8	Low-------	0.28			
	27-60	---	---	---	---	---	----------	----			
Klanelneechena-	11-0	0-3	0.05-0.15	2.0-6.0	0.32-0.35	5.6-6.5	Low-------	0.05	1	8	65-85
	0-2	0-10	0.95-1.15	0.6-2.0	0.22-0.24	6.1-7.3	Low-------	0.37			
	2-18	0-5	1.40-1.55	6.0-20	0.04-0.06	6.1-7.3	Low-------	0.02			
	18-60	---	---	---	---	---	----------	----			
475----------- Wrangell	0-23	0-3	0.10-0.15	2.0-6.0	0.32-0.35	5.6-7.3	Low-------	0.05	2	8	65-85
	23-37	40-75	1.50-1.60	0.06-0.2	0.06-0.12	7.4-8.4	Moderate--	0.24			
	37-60	---	---	---	---	---	----------	----			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14—PHYSICAL ANALYSES FOR SELECTED SOILS

(A dash indicates that the material was not detected. A blank indicates that a determination was not made. TR indicates a trace amount of the element.)

Soil name and sample number	Horizon	Depth	Particle-size distribution: Sand: Very coarse 2.0-1.0 mm	Sand: Coarse 1.0-0.5 mm	Sand: Med. 0.5-0.25 mm	Sand: Fine 0.25-0.1 mm	Sand: Very fine 0.1-0.05 mm	Sand: Total 2.0-0.05 mm	Silt 0.05-0.002 mm	Clay <0.002 mm	Water content: 1/3 bar	Water content: 15 bar	Water content: Water retention	Bulk density: 1/3 bar	Bulk density: Oven-dry
		In	Pct								Pct(wt)			g/cc	
Chitina (411)	Oi	2-0	0.2	0.3	0.9	3.2	16.4	21.0	75.4	3.6		42.5			
S81AK-261-20	A	0-2	--	TR	0.3	3.8	18.4	22.5	76.3	1.2	25.7	5.9	0.28	1.43	1.43
61°40'40''N.	C1	2-4	TR	0.1	0.3	2.2	18.2	20.9	74.2	4.9	48.0	19.5	0.28	0.99	1.04
lat.	C2	4-7	TR	TR	0.2	2.7	18.8	21.7	76.5	1.8	40.7	16.0	0.22	0.89	0.94
141°41'50''W.	C3	7-14	TR	0.1	0.2	2.3	20.5	23.1	75.6	1.3	26.8	9.7	0.19	1.09	1.10
long.	C4	14-18	--	TR	0.1	7.2	40.6	47.9	50.8	1.3	21.2	7.2	0.16	1.12	1.13
	C5	18-30	--	TR	0.2	8.0	34.5	42.7	54.6	2.7	24.9	12.0	0.13	1.04	1.07
	Ab	30-33	TR	TR	0.3	9.1	34.7	44.1	53.8	2.1	28.3	8.7	0.20	1.02	1.03
	C6	33-36	--	0.1	0.5	10.2	23.2	34.0	58.9	7.1	18.4	6.2	0.17	1.38	1.39
	C7	36-44									21.1	7.4	0.18	1.29	1.29
	C8	44-49	0.1	0.1	1.2	9.4	28.6	39.4	56.0	4.6	13.7	3.3	0.16	1.49	1.49
	2C1	49-57	0.2	0.3	1.5	12.7	29.4	44.1	34.3	21.6		6.8		1.50	
	2C2	57-64	0.2	0.1	0.3	1.1	1.9	3.6	47.8	48.6	27.4	16.5	0.14	1.31	1.39
Chitina (412)	Oi	4-0	TR	0.9	1.5	4.8	20.5	27.7	70.6	1.7		46.8			
S81AK-261-018	C1	0-2	TR	0.2	0.6	3.1	20.6	24.5	73.3	2.2	24.6	9.8	0.13	0.89	0.91
61°40'40''N.	C2	2-11	TR	0.3	0.8	2.9	18.6	22.6	74.6	2.8	33.6	18.2	0.12	0.81	0.85
lat.	C3	11-19	--	TR	0.1	5.9	36.4	42.4	55.1	2.5	14.8	5.5	0.12	1.27	1.28
144°41'45''W.	C4	19-23	TR	0.1	0.3	4.5	25.0	29.9	66.1	4.0	32.1	14.1	0.17	0.92	0.95
long.	C5	23-31	0.1	0.1	0.4	11.9	40.2	52.7	45.7	1.6	11.4	3.7	0.11	1.44	1.44
Gakona (441)	Oi	1-0	0.1	1.2	1.6	3.9	12.9	19.7	76.4	3.9		33.0			
S81AK-261-013	A	0-1	0.1	0.3	0.7	3.0	5.2	9.3	85.0	5.7	26.9	11.9	0.14	0.96	0.97
61°44'00''N.	Bw	1-5	0.1	0.5	0.7	2.6	10.7	14.6	75.0	10.4	19.0	8.7	0.13	1.23	1.25
lat.	2C1	5-10	0.3	0.6	2.6	10.6	9.2	23.3	41.7	35.0	17.1	12.6	0.07	1.50	1.57
144°53'00''W.	2C2	10-17	TR	0.2	0.8	3.5	3.0	7.5	26.6	65.9	22.9	19.8	0.04	1.40	1.54
long.	2C3	17-31	0.1	0.1	0.4	1.5	0.1	2.2	22.9	74.9	25.1	21.5	0.05	1.40	1.53
	2C4	31-45	0.1	0.3	0.3	0.4	0.4	1.5	17.1	81.4	28.4	24.2	0.06	1.38	1.50
	2C5	45-51	0.8	1.2	0.7	1.6	10.5	14.8	65.8	19.4		7.3		1.40	
	2C6	51-63	0.1	TR	0.1	0.1	0.1	0.4	67.9	31.7	24.8	12.4	0.18	1.49	1.55
Gulkana (429)	A	0-1	0.2	0.3	0.6	3.7	19.1	23.9	71.8	4.3	20.5	8.1	0.13	1.01	1.03
S81AK-261-016	Bw1	1-4	0.1	0.3	1.1	5.2	17.5	24.2	68.3	7.5	16.9	6.2	0.11	1.05	1.06
61°57'40''N.	Bw2	4-13	0.2	0.4	1.7	11.4	26.4	40.1	52.1	7.8	15.1	5.8	0.13	1.35	1.39
lat.	2C1	13-36	11.6	25.7	38.7	19.8	1.9	97.7	2.3	--	12.3	1.3	0.08	1.65	1.65
145°18'50''W.	2C2	36-42	--	0.3	6.7	45.2	34.5	86.7	11.7	1.6		2.5		1.60	
long.	2C3	42-51	0.3	2.8	34.6	49.7	10.5	97.9	2.1	--		1.4		1.60	
	2C4	51-63	13.5	18.3	38.6	21.7	4.6	96.7	2.9	0.4		1.2		1.60	
Gulkana (429)	A	0-2	0.1	0.2	0.4	3.2	17.8	21.7	74.9	3.4		11.4			
S81AK-261-017	Bw	2-10	0.3	0.9	1.3	3.4	11.6	17.5	73.1	9.4		6.7			
61°57'30''N.	BC	10-12	0.8	1.4	3.5	8.0	20.8	34.5	57.7	7.8		5.9			
lat.	2C1	15-22	13.0	20.6	23.6	17.3	9.1	83.6	12.3	4.1		3.7			
145°20'00''W.	2C2	22-40	22.0	28.6	20.6	15.4	6.1	92.7	7.3	--		1.8			
long.	2C3	40-56	15.5	27.9	32.4	15.1	4.1	95.0	5.0	--		1.3			
Kenny Lake	Oi	2-0	TR	0.2	1.3	3.9	15.2	20.6	77.7	1.7	36.5	9.0	0.24	0.88	0.91
(407)	Bw	0-3	TR	0.1	0.2	1.8	8.8	10.9	86.8	2.3		18.9		0.80	
S81AK-261-21	Ab	3-6	0.1	0.1	0.2	1.5	12.0	13.9	82.3	3.8	23.4	8.6	0.18	1.22	1.23
61°40'50''N.	Bwb	6-11	TR	0.2	0.3	3.4	24.2	28.1	67.4	4.5	16.5	5.8	0.15	1.43	1.43
lat.	C	11-20	0.8	0.8	1.0	4.7	20.9	28.2	64.0	7.8	12.9	5.4	0.12	1.66	1.68
145°05'30''W.	2C1	20-26	10.1	10.0	9.6	8.6	2.8	41.1	17.1	41.8	17.7	12.7	0.07	1.54	1.59
long.	2C2	26-37	--	0.1	0.2	0.6	0.8	1.7	29.5	68.8	28.5	23.6	0.07	1.34	1.44
	2C3	37-51	0.2	0.2	0.4	1.1	2.5	4.4	39.8	55.8	27.2	21.7	0.08	1.38	1.45
	2C4	51-65	--	0.1	0.2	0.5	0.3	1.1	23.0	75.9	28.4	24.0	0.06	1.38	1.50

TABLE 14—PHYSICAL ANALYSES FOR SELECTED SOILS—Continued

Soil name and sample number	Horizon	Depth	Particle-size distribution: Sand: Very coarse 2.0-1.0 mm	Sand: Coarse 1.0-0.5 mm	Sand: Med. 0.5-0.25 mm	Sand: Fine 0.25-0.1 mm	Sand: Very fine 0.1-0.05 mm	Sand: Total 2.0-0.05 mm	Silt 0.05-0.002 mm	Clay <0.002 mm	Water content: 1/3 bar	Water content: 15 bar	Water content: Water retention	Bulk density: 1/3 bar	Bulk density: Oven-dry
		In	Pct								Pct(wt)			g/cc	
Klawasi (433)	Oe	9-4	0.2	6.1	6.2	9.0	16.8	38.3	58.1	3.6	260.1	75.5	0.30	0.16	0.32
S81AK-261-010	Oa	4-0	0.2	2.2	2.5	6.4	18.8	30.1	66.6	3.3	75.3	25.0	0.28	0.55	0.69
61°50'00''N.	Bw	0-1	0.9	2.0	4.7	9.4	10.6	27.6	55.1	17.3	15.2	8.4	0.12	1.76	1.78
lat.	2C1	1-6	0.9	1.6	3.8	7.6	0.3	14.2	39.9	45.9	27.5	17.3	0.13	1.34	1.53
145°20'00''W.	2C2	6-12	0.5	0.4	1.1	2.6	1.2	5.8	35.3	58.9	26.2	22.9	0.05	1.41	1.54
long.	2Cf	12-15	1.2	0.9	1.1	1.4	1.4	6.0	30.3	63.7		22.9		1.40	
Klutina (449)	A1	0-1	0.1	0.4	0.8	3.4	17.1	21.8	76.0	2.2	21.9	13.6	0.06	0.73	0.78
S81AK-261-011	A2	1-3	0.1	0.6	1.3	5.4	23.8	31.2	65.4	3.4	25.8	7.7	0.16	0.90	0.94
61°58'20''N.	Bw1	3-6	0.2	0.7	1.8	10.4	31.3	44.4	49.0	6.6	16.0	5.8	0.13	1.25	1.27
lat.	Bw2	6-15	1.2	2.6	5.6	20.0	26.4	55.8	40.5	3.7	10.6	3.6	0.10	1.43	1.44
145°18'40''W.	C	15-22	TR	0.3	1.3	7.3	18.9	27.8	65.7	6.5	16.9	4.4	0.17	1.36	1.39
long.	2C	22-38	19.5	23.6	18.7	19.2	10.3	91.3	8.7	--		1.7		1.60	
Tonsina (415)	A	0-2	TR	0.2	0.6	3.8	17.3	21.9	73.0	5.1	20.4	9.1	0.12	1.02	1.04
S81AK-261-22	Bw1	2-7	0.1	0.3	0.6	3.9	22.4	27.3	66.6	6.1	17.8	6.0	0.15	1.25	1.27
61°47'00''N.	Bw2	7-15	0.7	1.4	2.2	4.4	10.5	19.2	74.7	6.1	15.2	6.4	0.13	1.51	1.52
lat.	2C1	15-18	3.3	3.8	6.5	15.2	19.9	48.7	45.2	6.1		4.6		1.80	
145°05'30''W.	2C2	18-35	1.7	2.7	5.5	15.4	24.9	50.2	45.8	4.0	7.9	3.0	0.09	1.92	1.92
long.	2C3	35-52	2.1	2.2	5.3	16.2	25.0	50.8	44.7	4.5	9.7	2.8	0.12	1.79	1.79
	2C4	52-65	1.8	2.8	6.4	17.4	18.1	46.5	51.9	1.6	8.9	1.7	0.13	1.86	1.86

TABLE 15—CHEMICAL ANALYSES FOR SELECTED SOILS

(A dash indicates that the material was not detected. A blank indicates that a determination was not made. TR indicates a trace amount of the element. Extractable calcium is not reported when calcium carbonate is detected in the horizon.)

Soil name (map unit), sample number, and location	Horizon	Depth	Cation-exchange capacity: Sum of cations	Cation-exchange capacity: Ammonium acetate	pH: CaCl 0.01M (1:2)	pH: H2O (1:1)	Organic carbon	Total Nitrogen	Extractable Acidity	Extractable bases: Ca	Extractable bases: Mg	Extractable bases: K	Extractable bases: Na
		In	----Meq/100 g----				Pct	Pct	Meq/ 100 g	-------Meq/100 g-------			
Chitina (411)	Oi	2-0	101.9	77.8			20.53	0.669		87.2	14.1	0.5	0.1
S81AK-261-20	A	0-2		10.7	7.5	7.7	1.36	0.073			2.3	0.1	0.1
61°40'40''N.	C1	2-4	80.9	53.3	7.3	7.2	9.84	0.532	7.9	65.2	7.6	0.1	0.1
lat.	C2	4-7	58.2	37.1	7.3	7.3	6.16	0.346	4.8	47.0	6.0	0.1	0.3
41°41'50''W.	C3	7-14	41.7	24.9	7.1	7.2	3.79	0.173	4.8	31.4	5.2	0.1	0.2
long.	C4	14-18	26.5	16.4	7.0	7.2	2.54		3.1	19.5	3.7	0.1	0.1
	C5	18-30	43.6	28.2	7.1	7.2	5.00		3.8	33.1	6.0	0.1	0.6
	Ab	30-33	33.6	20.8	7.2	7.4	3.44		2.1	25.7	5.1	0.3	0.4
	C6	33-36	23.8	17.2	7.2	7.6	1.65		1.1	17.7	4.5	0.3	0.2
	C7	36-44	26.7	20.0	7.5	7.6	2.45		0.6	25.0	0.6	0.2	0.3
	C8	44-49		7.5	7.6	7.9	0.45				3.4	0.3	0.2
	2C1	49-57		11.4	7.7	7.9	0.40				5.9	0.4	0.4
	2C2	57-64		17.1	7.7	7.9	0.60			44.5	8.8	0.6	0.5
Chitina (412)	Oi	4-0	83.1	62.6			18.78	0.564	20.2	53.6	8.5	0.8	--
S81AK-261-018	C1	0-2	26.8	20.2	5.8	6.1	3.69	0.186	11.1	12.6	2.7	0.3	0.1
61°40'40''N.	C2	2-11	67.6	46.1	6.6	6.8	7.18	0.297	13.0	47.9	6.6	0.1	TR
lat.	C3	11-19	18.6	12.4	7.3	7.7	1.19	0.043	1.4	13.8	3.2	0.1	0.1
144°41'45''W.	C4	19-23	58.0	37.4	7.7	7.8	5.80		3.8	46.1	7.9	0.1	0.1
long.	C5	23-31	12.3	7.8	7.5	8.1	0.56		0.6	8.9	2.5	0.2	0.1
Gakona (441)	Oi	1-0	52.3	40.3			15.74	0.784	14.0	30.7	5.9	1.7	TR
S81AK-261-013	A	0-1	46.2	27.5	7.3	7.3	4.69	0.289	5.5	36.3	4.0	0.4	--
61°44'00''N.	Bw	1-5	26.2	19.5	7.3	7.6	1.74	0.110	3.4	17.8	4.8	0.2	TR
lat.	2C1	5-10	26.3	22.7	7.3	7.7	0.70	0.052	1.7	14.5	9.5	0.4	0.2
44°53'00''W.	2C2	10-17		25.8	7.8	8.1	0.74	0.051			13.5	0.4	0.7
long.	2C3	17-31		23.4	7.9	8.2	0.65				13.4	0.5	1.1
	2C4	31-45		22.3	7.9	7.9	0.61				13.0	0.6	1.1
	2C5	45-51		7.3	7.8	8.2	0.33				4.8	0.3	0.3
	2C6	51-63		10.6	8.0	8.1	0.45				6.7	0.4	0.5
Kenny Lake	Oi	2-0	36.3	22.6	7.4	7.5	3.77	0.177	4.2	26.7	4.4	0.7	0.3
(407)	Bw1	0-3	62.1	42.7	7.3	7.4	6.68	0.267	8.2	43.7	9.3	0.2	0.7
S81AK-261-21	Ab	3-6	32.2	21.6	7.3	7.7	3.09	0.131	3.6	22.5	5.5	0.1	0.5
61°40'50''N.	Bwb	6-11	18.1	13.1	7.3	7.9	1.03	0.068	1.5	12.6	3.5	0.1	0.4
lat.	C	11-20	15.4	12.5	7.4	8.0	0.45	0.035	0.9	10.0	3.9	0.2	0.4
144°45'50''W.	2C1	20-26		15.3	7.7	7.9	0.40				5.8	0.4	0.4
long.	2C2	26-37		21.5	7.8	7.9	0.53	0.039	30.0		8.4	0.6	0.5
	2C3	37-51		19.1	7.6	8.0	0.52				9.3	0.7	0.6
	2C4	51-65		18.8	7.9	8.1	0.53				10.1	0.7	0.5
Klawasi (433)	Oe	9-4	154.2	113.6			24.95	1.047	44.1	82.8	25.7	1.2	0.4
S81AK-261-010	Oa	4-0	88.6	68.8			11.87	0.626	26.5	49.0	12.7	0.2	0.2
61°50'00''N.	Bw	0-1	22.6	18.7	6.1	6.7	0.95	0.054	4.6	12.4	5.2	0.3	0.1
lat.	2C1	1-6	39.4	32.8	6.4	7.1	0.83	0.055	5.8	23.8	8.9	0.4	0.5
45°20'00''W.	2C2	6-12	41.1	32.3	7.3	7.8	0.83		3.1	29.2	8.1	0.4	0.3
long.	2Cf	12-15		25.1	7.6	8.1	0.70				6.5	0.5	0.4
Klutina (449)	A1	0-1	42.5	27.3	6.9	6.9	5.16	0.225	8.2	31.4	2.1	0.8	TR
S81AK-261-011	A2	1-3	29.5	19.7	7.2	7.5	2.92	0.130	3.4	24.2	1.4	0.5	TR
61°58'20''N	Bw1	3-6	16.5	13.1	6.9	7.4	0.90	0.054	2.4	12.2	1.5	0.4	TR
lat.	Bw2	6-15	9.9	7.8	6.7	7.3	0.65	0.027	1.2	7.1	1.2	0.4	TR
145°18'40''W.	C	15-22	15.6	9.7	7.4	7.9	0.68	0.034	0.8	11.4	3.1	0.2	0.1
long.	2C	22-38	6.0	3.5	7.1	7.8	0.18		0.5	4.1	1.1	0.2	0.1

TABLE 15—CHEMICAL ANALYSES FOR SELECTED SOILS—Continued

Soil name (map unit), sample number, and location	Horizon	Depth	Cation-exchange capacity		pH		Organic carbon	Total Nitrogen	Extractable acidity	Extractable bases			
			Sum of cations	Ammonium acetate	CaCl 0.01M (1:2)	H2O (1:1)				Ca	Mg	K	Na
		In	----Meq/100 g----				Pct	Pct	Meq/100 g	-------Meq/100 g-------			
Tonsina (415)	A	0-2	22.5	15.8	6.7	6.9	2.69	0.145	6.0	13.9	2.3	0.2	0.1
S81AK-261-022	Bw1	2-7	13.7	11.2	6.1	6.8	0.72	0.041	3.0	7.2	3.2	0.2	0.1
61°47'00''N.	Bw2	7-15	15.4	13.5	6.3	7.0	0.48	0.030	1.9	8.3	4.9	0.1	0.2
lat.	2C1	15-18	11.5	10.0	6.9	7.6	0.28	0.018	0.6	6.8	3.7	0.1	0.3
145°05'30''W.	2C2	18-35		5.4	7.7	8.4	0.18	0.009			2.3	0.1	0.3
long.	2C3	35-52		4.7	7.7	8.4	0.17				2.1	0.1	0.2
	2C4	52-65		3.2	7.7	8.4	0.17				1.7	0.2	0.1

TABLE 16—WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated.)

Map symbol and soil name	Hydrologic group	Flooding			High water table		
		Frequency	Duration	Months	Depth	Kind	Months
					Ft		
401*. Badlands.							
402------------------ Chistochina	B	None---------	---	---	>6.0	---	---
403, 404, 405, 406-- Copper River	D	None---------	---	---	0-1.0	Perched	Apr-Oct
407, 408, 409, 410-- Kenny Lake	B	None---------	---	---	>6.0	---	---
411, 412, 413, 414-- Chitina	B	None---------	---	---	>6.0	---	---
415, 416, 417, 418-- Tonsina	B	None---------	---	---	>6.0	---	---
419*:							
Copper River-------	D	None---------	---	---	0-1.0	Perched	Apr-Oct
Hanagita-----------	D	None---------	---	---	>6.0	---	---
420*:							
Tonsina------------	B	None---------	---	---	>6.0	---	---
Hanagita-----------	D	None---------	---	---	>6.0	---	---
421*:							
Cryochrepts.							
Rock outcrop.							
422*:							
Cryofibrists.							
Cryohemists.							
423. Cryohemists.							
424*:							
Cryorthents.							
Cryochrepts.							
425------------------ Dadina	D	None---------	---	---	1.0-2.0	Perched	Apr-Oct
426*:							
Dadina-------------	D	None---------	---	---	1.0-2.0	Perched	Apr-Oct
Klanelneechena-----	D	None---------	---	---	1.0-2.0	Perched	Apr-Oct

*See footnote at end of table.

TABLE 16—WATER FEATURES—Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table		
		Frequency	Duration	Months	Depth	Kind	Months
					Ft		
427*:							
Dadina-------------	D	None---------	---	---	1.0-2.0	Perched	Apr-Oct
Tolsona------------	D	None---------	---	---	1.0-2.0	Perched	Apr-Oct
428*. Pits.							
429*, 430, 431, 432- Gulkana	B	None---------	---	---	>6.0	---	---
433, 434, 435, 436, 437---------------- Klawasi	D	None---------	---	---	1.0-2.0	Perched	Apr-Oct
438----------------- Klawasi	D	None---------	---	---	0-1.0	Perched	Apr-Oct
439, 440, 441, 442, 443, 444----------- Gakona	B	None---------	---	---	>6.0	---	---
445*:							
Klawasi------------	D	None---------	---	---	1.0-2.0	Perched	Apr-Oct
Tolsona------------	D	None---------	---	---	1.0-2.0	Perched	Apr-Oct
446*:							
Gakona-------------	B	None---------	---	---	>6.0	---	---
Stuck--------------	C	None---------	---	---	2.5-3.5	Apparent	Apr-Oct
447*:							
Gakona-------------	B	None---------	---	---	>6.0	---	---
Chetaslina---------	B	None---------	---	---	>6.0	---	---
448*:							
Klawasi------------	D	None---------	---	---	1.0-2.0	Perched	Apr-Oct
Wrangell-----------	D	None---------	---	---	0-1.0	Perched	Apr-Oct
Klawasi------------	D	None---------	---	---	0-1.0	Perched	Apr-Oct
449*:							
Klutina------------	B	Occasional---	Brief-----	Apr-Aug	>6.0	---	---
Klutina------------	B	Rare---------	---	---	>6.0	---	---
450----------------- Klutina	B	Rare---------	---	---	>6.0	---	---
451*:							
Klutina------------	B	Occasional---	Brief-----	Apr-Aug	>6.0	---	---
Nizina-------------	A	Occasional---	Brief-----	Apr-Aug	>6.0	---	---
Klutina------------	B	Rare---------	---	---	>6.0	---	---

*See footnote at end of table.

TABLE 16—WATER FEATURES—Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table		
		Frequency	Duration	Months	Depth	Kind	Months
					Ft		
452, 453------------ Kuslina	D	None---------	---	---	1.0-1.5	Perched	Apr-Oct
454----------------- Mendeltna	D	None---------	---	---	1.0-2.0	Perched	Apr-Oct
455, 456------------ Chetaslina	B	None---------	---	---	>6.0	---	---
457*:							
Mendeltna----------	D	None---------	---	---	1.0-2.0	Perched	Apr-Oct
Tebay--------------	B	None---------	---	---	>6.0	---	---
458*:							
Nizina-------------	A	Occasional---	Brief-----	Apr-Aug	>6.0	---	---
Nizina-------------	A	Rare---------	---	---	>6.0	---	---
459, 460------------ Pippin	A	None---------	---	---	>6.0	---	---
461*:							
Riverwash.							
Nizina-------------	A	Frequent-----	Brief-----	Apr-Aug	>6.0	---	---
462----------------- Taral	B	None---------	---	---	>6.0	---	---
463*:							
Taral--------------	B	None---------	---	---	>6.0	---	---
Hanagita-----------	D	None---------	---	---	>6.0	---	---
464*:							
Strelna------------	C	None---------	---	---	>6.0	---	---
Hanagita-----------	D	None---------	---	---	>6.0	---	---
Copper River-------	D	None---------	---	---	0-1.0	Perched	Apr-Oct
465, 466, 467, 468-- Tebay	B	None---------	---	---	>6.0	---	---
469, 470------------ Tolsona	D	None---------	---	---	1.0-2.0	Perched	Apr-Oct
471, 472, 473------- Tsana	B	None---------	---	---	>6.0	---	---
474*:							
Tolsona------------	D	None---------	---	---	1.0-2.0	Perched	Apr-Oct
Klanelneechena-----	D	None---------	---	---	1.0-2.0	Perched	Apr-Oct
475----------------- Wrangell	D	None---------	---	---	0-1.0	Perched	Apr-Oct

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17—SOIL FEATURES

(The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated.)

Map symbol and soil name	Bedrock		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	In		In	In			
401*. Badlands.							
402---------------------- Chistochina	>60	---	---	---	Low-------	Moderate--	Low.
403, 404, 405, 406------ Copper River	>60	---	2-6	6-12	High------	High------	Moderate.
407, 408, 409, 410------ Kenny Lake	>60	---	---	---	High------	High------	Low.
411, 412, 413, 414------ Chitina	>60	---	---	---	High------	High------	Low.
415, 416, 417, 418------ Tonsina	>60	---	---	---	High------	High------	Low.
419*:							
Copper River-----------	>60	---	2-6	6-12	High------	High------	Moderate.
Hanagita---------------	12-20	Hard	---	---	High------	Moderate--	Low.
420*:							
Tonsina----------------	>60	---	---	---	High------	High------	Low.
Hanagita---------------	12-20	Hard	---	---	High------	Moderate--	Low.
421*:							
Cryochrepts.							
Rock outcrop.							
422*:							
Cryofibrists.							
Cryohemists.							
423. Cryohemists.							
424*:							
Cryorthents.							
Cryochrepts.							
425---------------------- Dadina	>60	---	0-6	6-12	Moderate--	Moderate--	Low.
426*:							
Dadina-----------------	>60	---	0-6	6-12	Moderate--	Moderate--	Low.
Klanelneechena---------	>60	---	0-6	6-12	High------	Moderate--	Moderate.

*See footnote at end of table.

TABLE 17—SOIL FEATURES—Continued

Map symbol and soil name	Bedrock		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	In		In	In			
427*:							
Dadina-----------------	>60	---	0-6	6-12	Moderate--	Moderate--	Low.
Tolsona----------------	>60	---	0-6	6-12	High------	Moderate--	Low.
428*. Pits.							
429*, 430, 431, 432----- Gulkana	>60	---	---	---	High------	High------	Low.
433, 434, 435, 436, 437, 438-------------------- Klawasi	>60	---	0-6	6-12	High------	High------	Low.
439, 440, 441, 442, 443, 444-------------------- Gakona	>60	---	---	---	Moderate--	High------	Low.
445*:							
Klawasi----------------	>60	---	0-6	6-12	High------	High------	Low.
Tolsona----------------	>60	---	0-6	6-12	High------	Moderate--	Low.
446*:							
Gakona-----------------	>60	---	---	---	Moderate--	High------	Low.
Stuck------------------	>60	---	---	---	Moderate--	High------	Low.
447*:							
Gakona-----------------	>60	---	---	---	Moderate--	High------	Low.
Chetaslina-------------	>60	---	---	---	Moderate--	High------	Low.
448*:							
Klawasi----------------	>60	---	0-6	6-12	High------	High------	Low.
Wrangell---------------	>60	---	6-12	12-24	High------	High------	Moderate.
Klawasi----------------	>60	---	0-6	6-12	High------	High------	Low.
449*:							
Klutina----------------	>60	---	---	---	Low-------	High------	Low.
Klutina----------------	>60	---	---	---	Low-------	High------	Low.
450--------------------- Klutina	>60	---	---	---	Low-------	High------	Low.
451*:							
Klutina----------------	>60	---	---	---	Low-------	High------	Low.
Nizina-----------------	>60	---	---	---	Low-------	High------	Low.
Klutina----------------	>60	---	---	---	Low-------	High------	Low.
452, 453---------------- Kuslina	>60	---	0-6	6-12	High------	High------	Low.

*See footnote at end of table.

TABLE 17—SOIL FEATURES—Continued

Map symbol and soil name	Bedrock		Subsidence		Potential frost action	Risk of corrosion	
	Depth	Hardness	Initial	Total		Uncoated steel	Concrete
	In		In	In			
454--------------------- Mendeltna	>60	---	0-6	6-12	High------	High------	Low.
455, 456---------------- Chetaslina	>60	---	---	---	Moderate--	High------	Low.
457*:							
Mendeltna--------------	>60	---	0-6	6-12	High------	High------	Low.
Tebay------------------	>60	---	---	---	Moderate--	Moderate--	Low.
458*:							
Nizina-----------------	>60	---	---	---	Low-------	High------	Low.
Nizina-----------------	>60	---	---	---	Low-------	High------	Low.
459, 460---------------- Pippin	>60	---	---	---	Low-------	High------	Low.
461*: Riverwash.							
Nizina-----------------	>60	---	---	---	Low-------	High------	Low.
462--------------------- Taral	>60	---	---	---	High------	Moderate--	Low.
463*:							
Taral------------------	>60	---	---	---	High------	Moderate--	Low.
Hanagita---------------	12-20	Hard	---	---	High------	Moderate--	Low.
464*:							
Strelna----------------	>60	---	0-6	10-20	High------	High------	Low.
Hanagita---------------	12-20	Hard	---	---	High------	Moderate--	Low.
Copper River-----------	>60	---	2-6	6-12	High------	High------	Moderate.
465, 466, 467, 468------ Tebay	>60	---	---	---	Moderate--	Moderate--	Low.
469, 470---------------- Tolsona	>60	---	0-6	6-12	High------	Moderate--	Low.
471, 472, 473----------- Tsana	>60	---	---	---	Moderate--	Moderate--	Low.
474*:							
Tolsona----------------	>60	---	0-6	6-12	High------	Moderate--	Low.
Klanelneechena---------	>60	---	0-6	6-12	High------	Moderate--	Moderate.
475--------------------- Wrangell	>60	---	6-12	12-24	High------	High------	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18—CLASSIFICATION OF THE SOILS
Copper River Area

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics that are outside the range of the series.)

Soil name	Family or higher taxonomic class
Chetaslina	TYPIC CRYOCHREPTS, FINE-LOAMY, MIXED
Chistochina	TYPIC CRYOCHREPTS, SANDY, MIXED
Chitina	CUMULIC CRYOBOROLLS, COARSE-SILTY, MIXED
Copper River	PERGELIC CRYAQUOLLS, LOAMY, MIXED
Cryochrepts	CRYOCHREPTS
Cryofibrists	CRYOFIBRISTS
Cryohemists	CRYOHEMISTS
Cryorthents	CRYORTHENTS
Dadina	HISTIC PERGELIC CRYAQUEPTS, SANDY-SKELETAL, MIXED
Gakona	TYPIC CRYORTHENTS, VERY-FINE, MIXED (CALCAREOUS)
Gulkana	TYPIC CRYOCHREPTS, COARSE-SILTY OVER SANDY OR SANDY-SKELETAL, MIXED
Hanagita	LITHIC CRYOBOROLLS, LOAMY, MIXED
Kenny Lake	CUMULIC CRYOBOROLLS, COARSE-SILTY OVER CLAYEY, MIXED
Klanelneechena	PERGELIC CRYAQUOLLS, SANDY, MIXED
Klawasi	HISTIC PERGELIC CRYAQUEPTS, CLAYEY, MIXED, NONACID
Klutina	TYPIC CRYOFLUVENTS, COARSE-LOAMY OVER SANDY OR SANDY-SKELETAL, MIXED, NONACID
Kuslina	HISTIC PERGELIC CRYAQUEPTS, LOAMY, MIXED, NONACID
Mendeltna	HISTIC PERGELIC CRYAQUEPTS, LOAMY, MIXED, NONACID
Nizina	TYPIC CRYORTHENTS, SANDY-SKELETAL, MIXED
Pippin	TYPIC CRYOCHREPTS, SANDY-SKELETAL, MIXED
Strelna	PERGELIC CRYOBOROLLS, LOAMY, MIXED
Stuck	AQUIC CRYOBOROLLS, SANDY OVER CLAYEY, MIXED
Taral	PACHIC CRYOBOROLLS, COARSE-LOAMY, MIXED
Tebay	TYPIC CRYOCHREPTS, COARSE-LOAMY, MIXED
Tolsona	HISTIC PERGELIC CRYAQUEPTS, LOAMY, MIXED, NONACID
Tonsina	CUMULIC CRYOBOROLLS, COARSE-LOAMY, MIXED
Tsana	TYPIC CRYORTHENTS, COARSE-LOAMY, MIXED, NONACID
Wrangell	PERGELIC CRYOHEMISTS, EUIC

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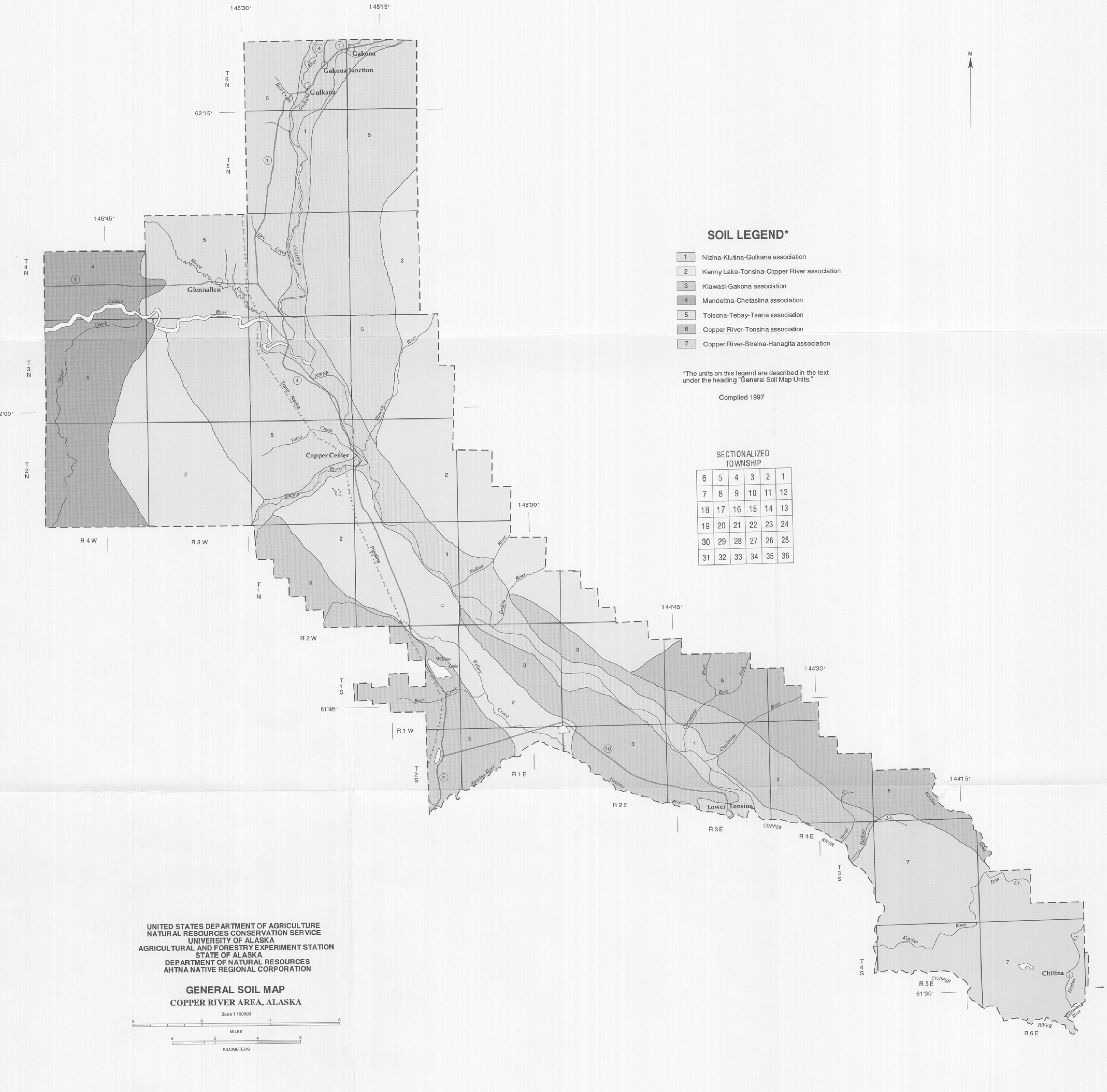


SOIL LEGEND*

1	Nizina-Klutina-Gulkana association
2	Kenny Lake-Tonsina-Copper River association
3	Klawasi-Gakona association
4	Mendeltna-Chetaslina association
5	Tolsona-Tebay-Tsana association
6	Copper River-Tonsina association
7	Copper River-Strelna-Hanagita association

*The units on this legend are described in the text under the heading "General Soil Map Units."

Compiled 1997

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
UNIVERSITY OF ALASKA
AGRICULTURAL AND FORESTRY EXPERIMENT STATION
STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
AHTNA NATIVE REGIONAL CORPORATION

GENERAL SOIL MAP

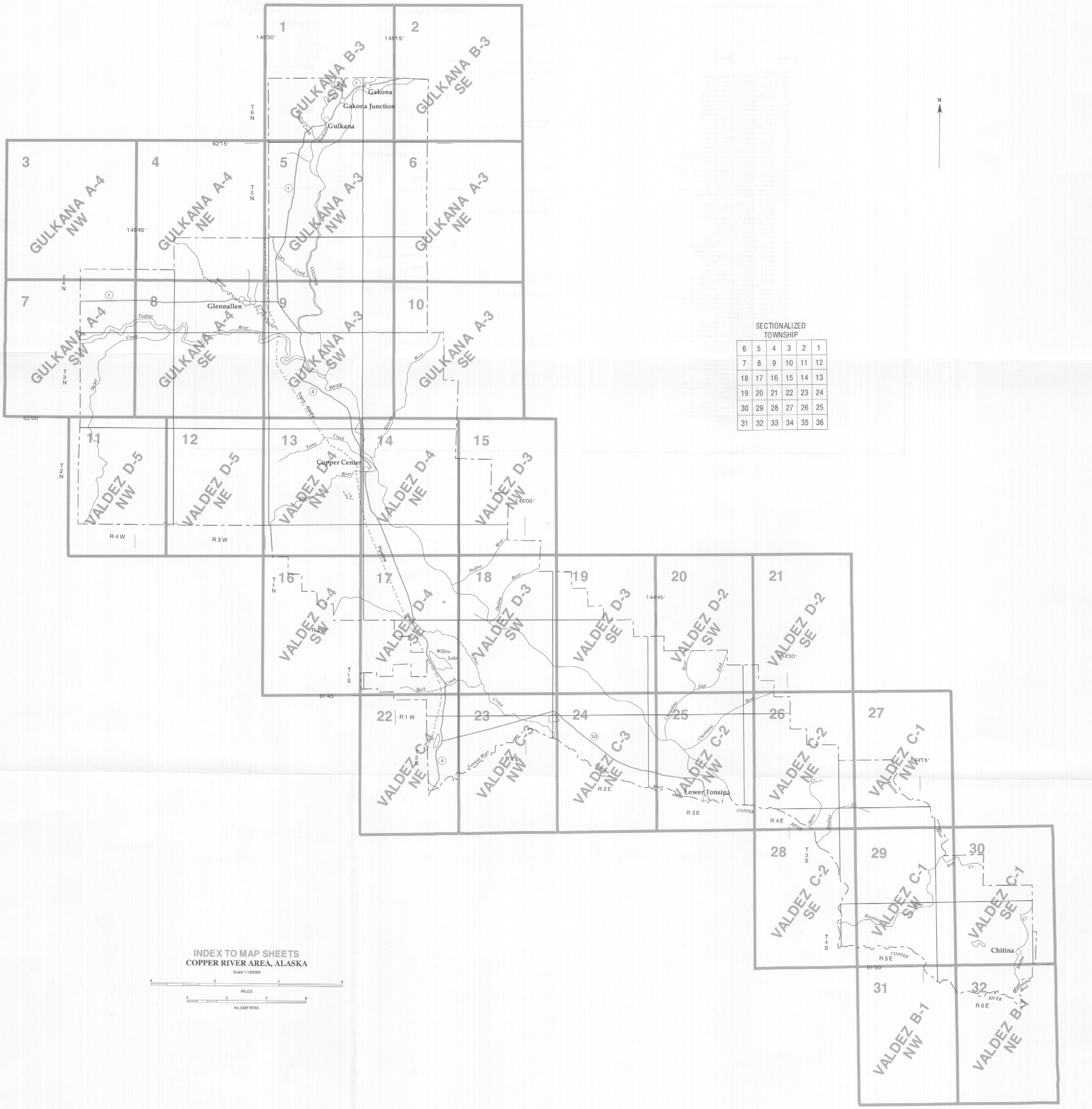
COPPER RIVER AREA, ALASKA

Scale 1:190080

4 0 4 8
MILES

4 0 4 8
KILOMETERS

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



INDEX TO MAP SHEETS
COPPER RIVER AREA, ALASKA
Scale 1:190080

SOIL LEGEND

Map symbols are numerical. They are not assigned to the map units in alphabetical order.

SYMBOL	NAME
401	Badlands
402	Chistochina silt loam, 0 to 7 percent slopes
403	Copper River peat, 0 to 2 percent slopes
404	Copper River peat, 2 to 7 percent slopes
405	Copper River peat, 7 to 12 percent slopes
406	Copper River peat, 12 to 20 percent slopes
407	Kenny Lake silt loam, 0 to 2 percent slopes
408	Kenny Lake silt loam, 2 to 7 percent slopes
409	Kenny Lake silt loam, 7 to 12 percent slopes
410	Kenny Lake silt loam, 12 to 20 percent slopes
411	Chitina silt loam, 0 to 2 percent slopes
412	Chitina silt loam, 2 to 7 percent slopes
413	Chitina silt loam, 7 to 12 percent slopes
414	Chitina silt loam, 12 to 20 percent slopes
415	Tonsina silt loam, 0 to 2 percent slopes
416	Tonsina silt loam, 2 to 7 percent slopes
417	Tonsina silt loam, 7 to 12 percent slopes
418	Tonsina silt loam, 12 to 20 percent slopes
419	Copper River-Hanagita complex, 2 to 20 percent slopes
420	Tonsina-Hanagita complex, 2 to 20 percent slopes
421	Cryochrepts-Rock outcrop complex, 30 to 70 percent slopes
422	Cryofibrists-Cryohemists complex, 0 to 2 percent slopes
423	Cryohemists, 0 to 2 percent slopes
424	Cryorthents and Cryochrepts, 30 to 70 percent slopes
425	Dadina peat, 0 to 2 percent slopes
426	Dadina-Klanelneechena complex, 0 to 2 percent slopes
427	Dadina-Tolsona complex, 0 to 5 percent slopes
428	Pits, gravel
429	Gulkana silt loam, 0 to 2 percent slopes
430	Gulkana silt loam, 2 to 7 percent slopes
431	Gulkana silt loam, 7 to 12 percent slopes
432	Gulkana silt loam, 12 to 20 percent slopes
433	Klawasi peat, 0 to 2 percent slopes
434	Klawasi peat, 2 to 7 percent slopes
435	Klawasi peat, 7 to 12 percent slopes
436	Klawasi peat, cool, 0 to 7 percent slopes
437	Klawasi peat, cool, 7 to 20 percent slopes
438	Klawasi peat, depressional, 0 to 2 percent slopes
439	Gakona silt loam, cool, 0 to 7 percent slopes
440	Gakona silt loam, cool, 7 to 20 percent slopes
441	Gakona silt loam, 0 to 2 percent slopes
442	Gakona silt loam, 2 to 7 percent slopes
443	Gakona silt loam, 7 to 12 percent slopes
444	Gakona silt loam, 12 to 20 percent slopes
445	Klawasi-Tolsona complex, 0 to 2 percent slopes
446	Gakona-Stuck complex, 0 to 2 percent slopes
447	Gakona-Chetaslina complex, 0 to 2 percent slopes
448	Klawasi-Wrangell complex, 0 to 2 percent slopes
449	Klutina-Klutina, rarely flooded, complex, 0 to 2 percent slopes
450	Klutina silt loam, rarely flooded, 2 to 7 percent slopes
451	Klutina-Nizina complex, 0 to 2 percent slopes
452	Kuslina peat, 0 to 2 percent slopes
453	Kuslina peat, 2 to 7 percent slopes
454	Mendeltna peat, 0 to 7 percent slopes
455	Chetaslina silt loam, 0 to 7 percent slopes
456	Chetaslina silt loam, thin surface, 0 to 7 percent slopes
457	Mendeltna-Tebay complex, 0 to 10 percent slopes
458	Nizina-Nizina, rarely flooded, complex, 0 to 5 percent slopes
459	Pippin silt loam, 0 to 12 percent slopes
460	Pippin silt loam, 12 to 45 percent slopes
461	Riverwash-Nizina complex, 0 to 2 percent slopes
462	Taral mucky silt loam, 20 to 45 percent slopes
463	Taral-Hanagita complex, 12 to 35 percent slopes
464	Strelna-Hanagita-Copper River complex, 15 to 55 percent slopes
465	Tebay silt loam, 0 to 7 percent slopes
466	Tebay silt loam, 7 to 20 percent slopes
467	Tebay silt loam, thin surface, 0 to 7 percent slopes
468	Tebay silt loam, thin surface, 7 to 20 percent slopes
469	Tolsona peat, 0 to 7 percent slopes
470	Tolsona peat, 7 to 12 percent slopes
471	Tsana silt loam, 0 to 7 percent slopes
472	Tsana silt loam, thin surface, 0 to 7 percent slopes
473	Tsana silt loam, thin surface, 7 to 20 percent slopes
474	Tolsona-Klanelneechena complex, 0 to 7 percent slopes
475	Wrangell peat, 0 to 2 percent slopes
W	Water

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

Limit of soil survey (label)

Field sheet matchline and neatline

LAND DIVISION CORNER
(sections and land grants)

ROADS

County, farm or ranch

ROAD EMBLEM & DESIGNATIONS

State 52

PIPE LINE (normally not shown)

PITS

Gravel pit (1-5 acres)

WATER FEATURES

DRAINAGE

Perennial, double line

Perennial, single line

LAKES, PONDS AND RESERVOIRS

Perennial

MISCELLANEOUS WATER FEATURES

Wet spot (1-5 acres) Ψ

SPECIAL SYMBOLS FOR SOIL SURVEY

SOIL DELINEATIONS AND SYMBOLS 461 448

SHORT STEEP SLOPE

MISCELLANEOUS

Rock outcrop (includes sandstone and shale) (1-5 acres) V

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1978 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

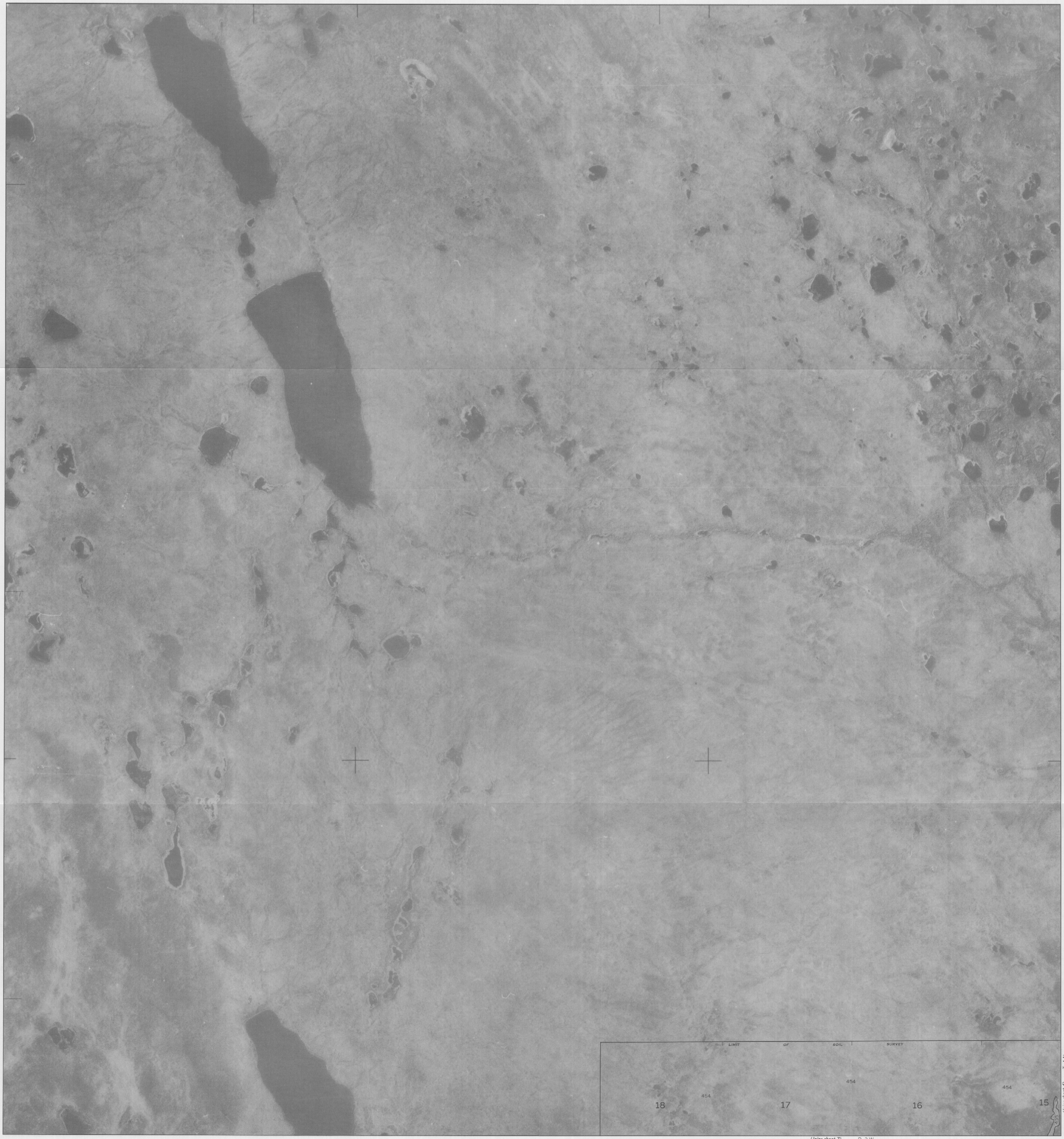
SCALE 1:24 000

N

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1978 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

N



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1978 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

N

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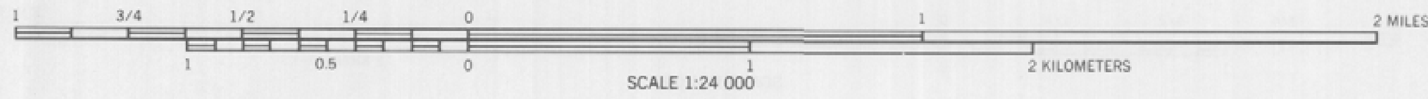
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

N

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE



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U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 6
COPPER RIVER AREA, ALASKA

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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

N

R. 3 W. (Joins sheet 3)

R. 3 W. (Joins sheet 11)

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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

N

R. 3 W. | R. 2 W.

(Joins sheet 4)

(Joins sheet 11) | (Joins sheet 12)

R. 3 W. | R. 2 W.

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1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

N

R. 2 W. | R. 1 W. (Joins sheet 5) R. 1 W. | R. 1 E.

R. 2 W. | R. 1 W. R. 1 W. | R. 1 E.
(Joins sheet 13) | (Joins sheet 14)

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1978 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

N

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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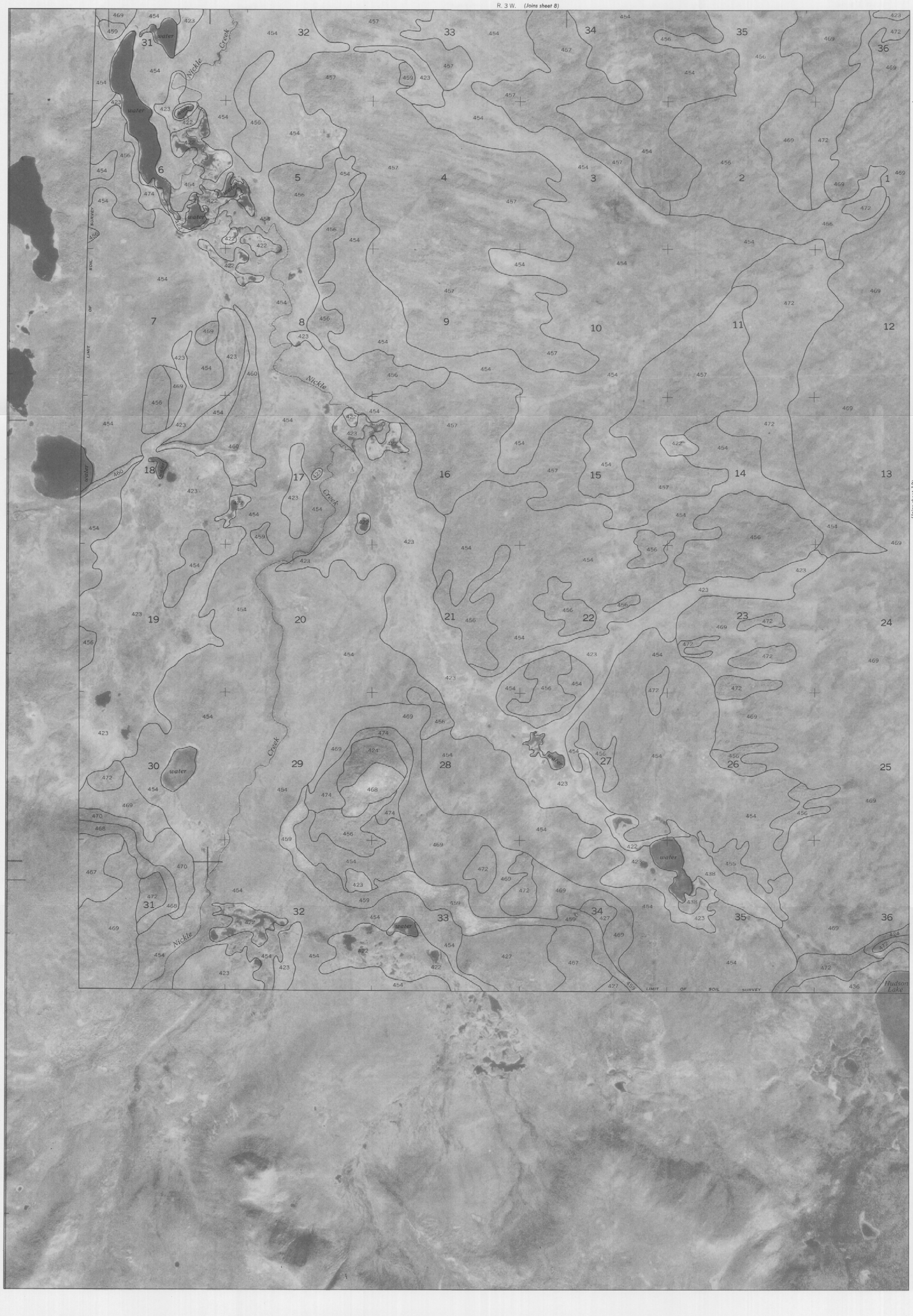

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1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

N

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 13
COPPER RIVER AREA, ALASKA

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

N

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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

N

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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

N

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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

N

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1978 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

N

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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

N

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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

N

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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

N

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N

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SCALE 1:24 000

N

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SHEET NO. 24
COPPER RIVER AREA, ALASKA

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1 3/4 1/2 1/4 0 1 2 MILES

1 0.5 0 1 2 KILOMETERS

SCALE 1:24 000

N

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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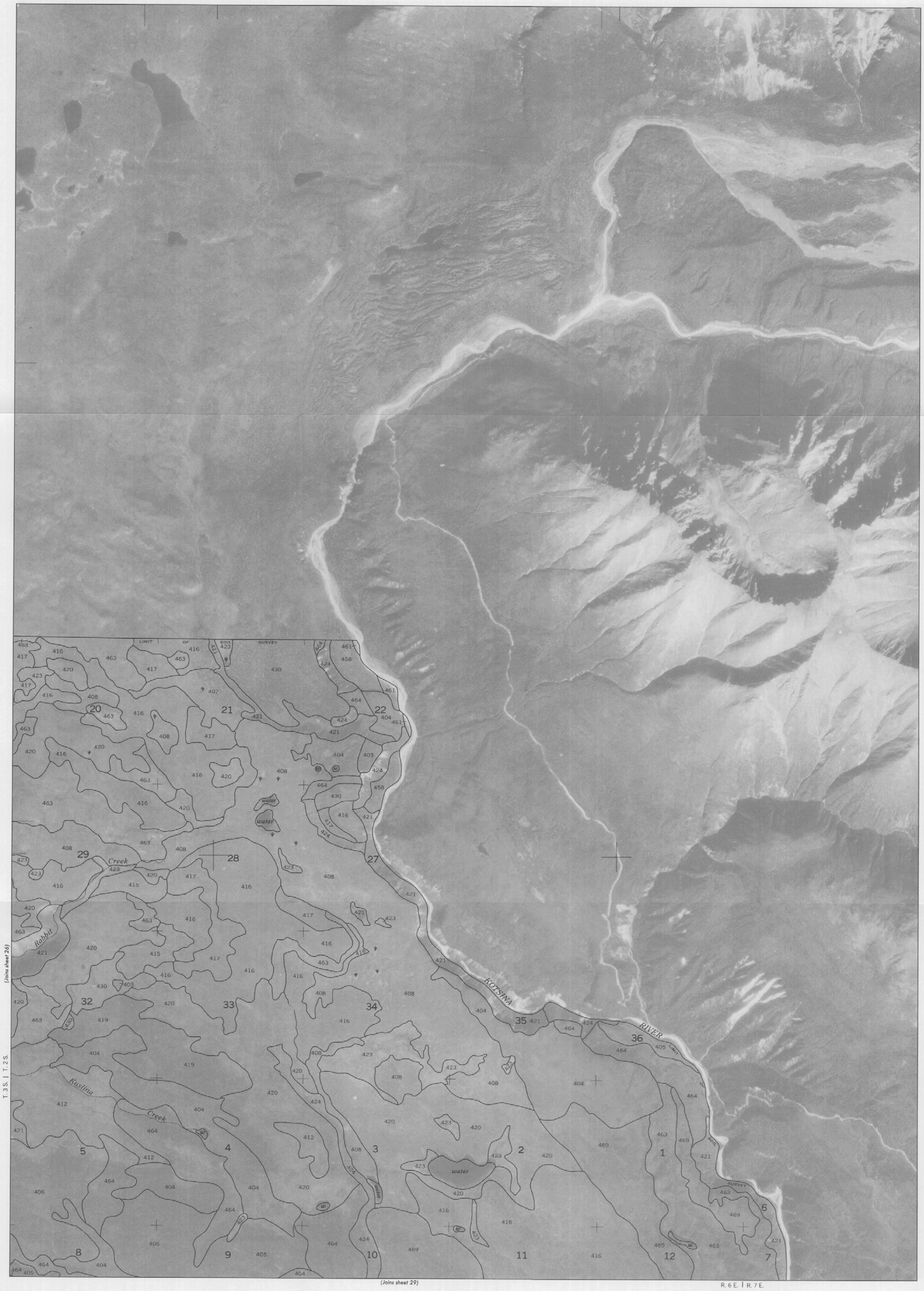
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

N

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1978 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

N



This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1978 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

N

1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

N

This soil survey map was compiled by the U.S. Department of Agriculture, Soil Conservation Service, and cooperating agencies. Base maps are orthophotographs prepared by the U.S. Department of the Interior, Geological Survey, from 1978 - 1980 aerial photography. Coordinate grid ticks and land division corners, if shown, are approximately positioned.

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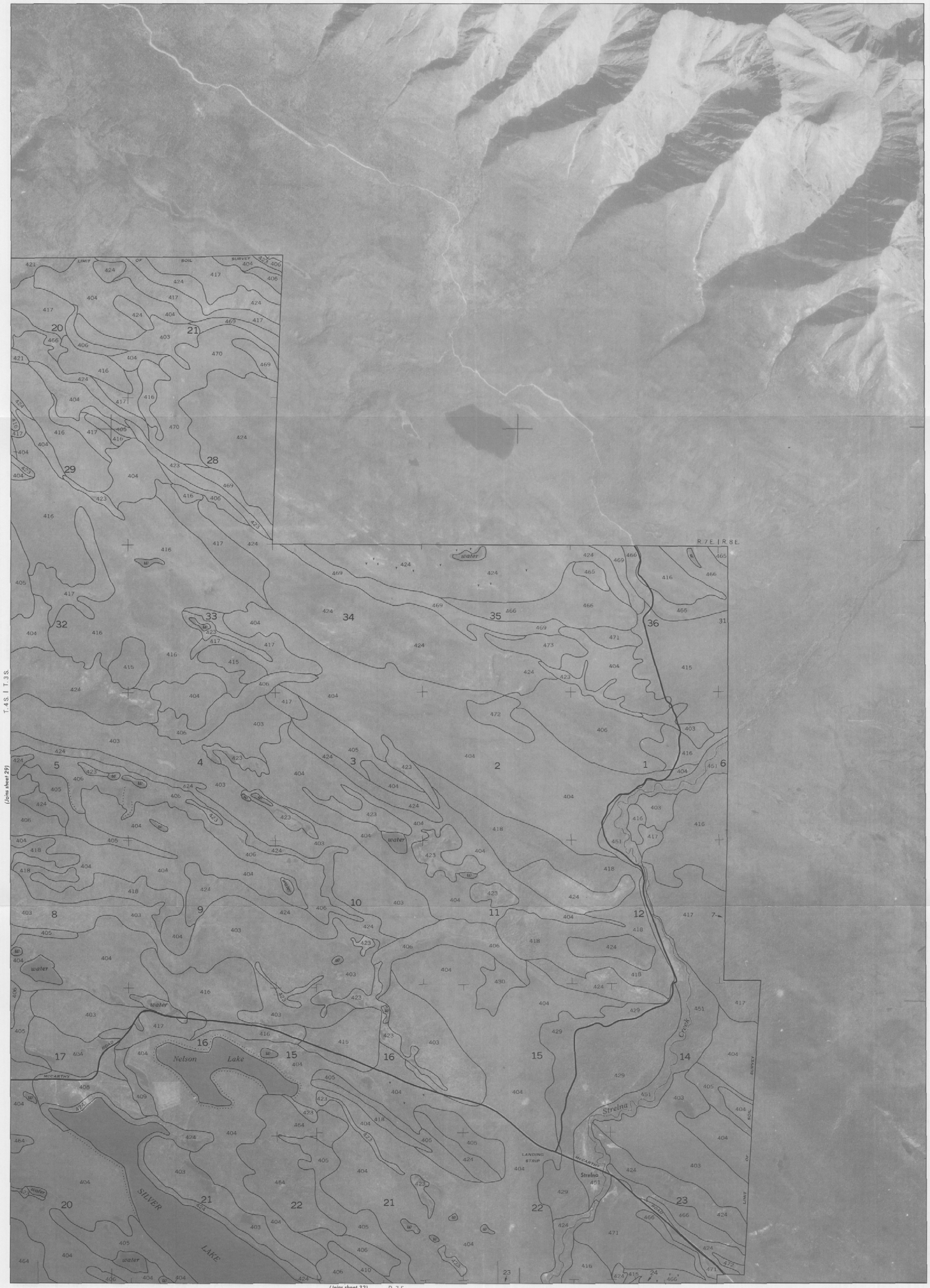
1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

N

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE



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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

N

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SCALE 1:24 000

N

U. S. DEPARTMENT OF AGRICULTURE
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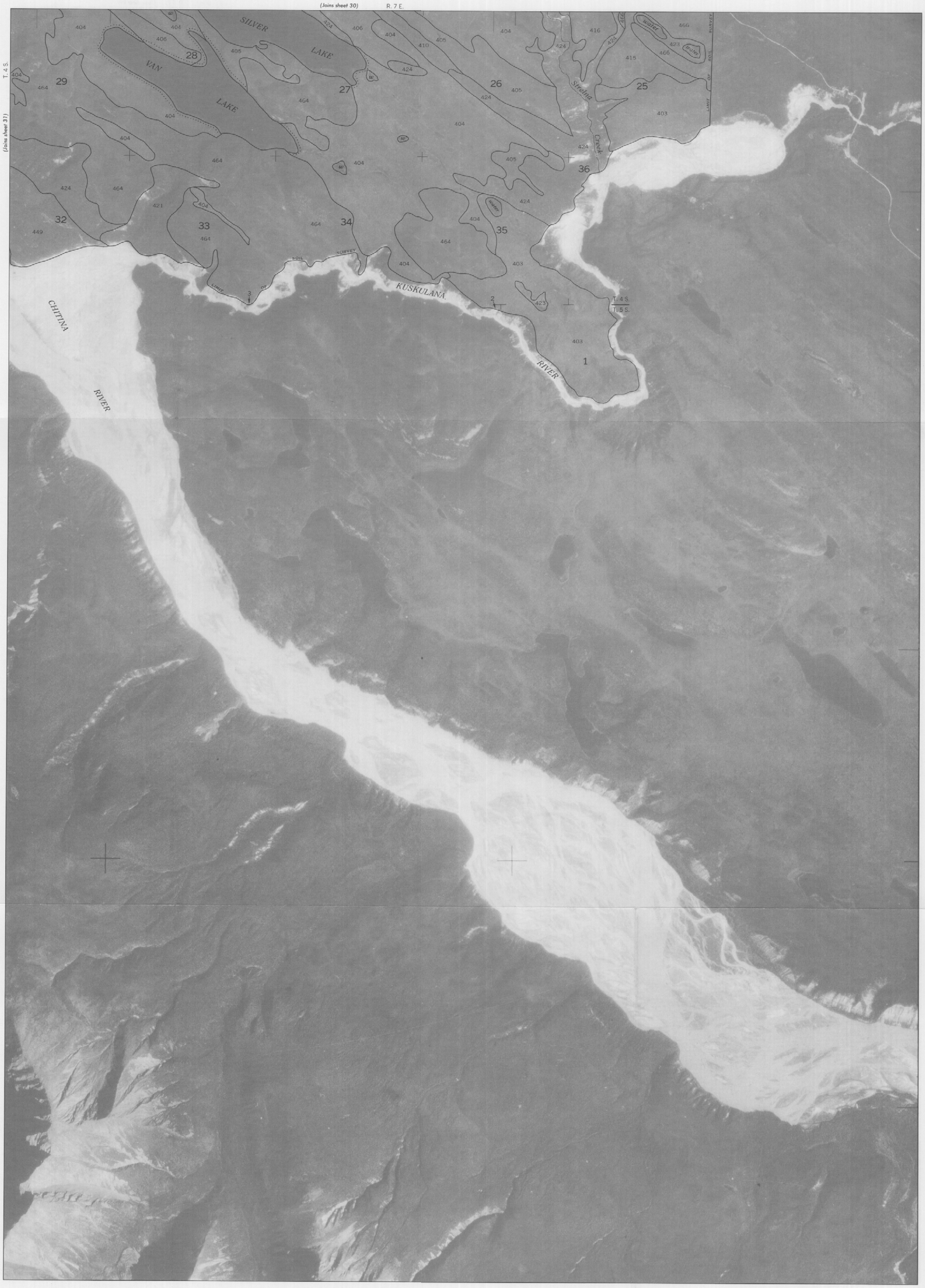

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1 3/4 1/2 1/4 0 1 2 MILES
1 0.5 0 1 2 KILOMETERS
SCALE 1:24 000

N